THE BEHAVIOUR CHANGE PROCESS OF SODIS ADOPTION

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Vorgelegt von
Silvie Kraemer
geboren in Stuttgart, Deutschland

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Prof. Dr. Heinz Gutscher und Herrn Prof. Dr. Hans-Joachim Mosler.

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Abstract:

Solar water disinfection (SODIS) is a sustainable water treatment method. With the help of the sun and plastic bottles, water is treated and illnesses prevented. Adoption and dissemination of SODIS is usually not as widespread and fast as can be expected, given the method's usefulness. Thus, the behaviour change process from drinking raw water to preparing and consuming SODIS on a regular basis has been examined here and aligned with an existing behaviour change model: The I-Change Model. This dissertation includes three sets of analyses that have been done for the three major phases that the Model theorizes. The aim is to identify those factors that drive the uptake, the interventions that influence behaviour-changing factors and the variables that differentiate between stages of change. Additionally, we are examining whether the I-Change Model fits the results of the actual behaviour change as it was found in a 3 year longitudinal field study in high-density areas in Zimbabwe.

The first step of analysis identified those factors that drive the uptake. It could be shown which persuasion factors are influencing the early dissemination and adoption of SODIS. Later on in the behaviour change process, these factors become less important. As a next step, different interventions were analyzed and the most successful ones amongst those used were identified. Additionally, it was examined how and through which behaviour changing factors interventions influence behaviour. The third analysis used the long-term data acquired to identify different user types. This gives a new understanding of how people's usage or non-usage behaviour develops over time and what drives this change. This dissertation integrates these analyses and their findings to display the behaviour change process that people are moving through and psychological factors that influence this change. It could be shown that the results fit well with the theoretical assumptions of the I-Change Model. Overall, the findings enhance the

understanding of the different stages of behaviour change and which factors are important in which stage. These insights are used to draw conclusions about when and why to use which interventions in a campaign that is aimed at changing behaviour.

Zusammenfassung:

Solare Wasserdesinfektion (SODIS) ist eine nachhaltige Wasserbehandlungsmethode. Mit Hilfe der Sonne und Plastikflaschen wird das Wasser gereinigt und Krankheiten vermieden. Die Aufnahme und Verbreitung von SODIS ist normalerweise nicht so weitgreifend und schnell, wie man bei so einer nützlichen Methode erwarten würde. Daher wurde in der vorliegenden Dissertation der Prozess der Verhaltensänderung vom Konsum von Rohwasser bis hin zum regelmässigen Gebrauch von SODIS untersucht. Als Grundlage dient das I-Change Modell, ein Modell zur Verhaltensänderung, mit welchem die Befunde abgeglichen wurden. Die vorliegende Dissertation beinhaltet drei verschiedene Untersuchungen, eine für jede der drei Hauptphasen, welche vom Modell angenommen werden. Das allgemeine Ziel ist die Identifikation von den Faktoren, die die Aufnahme von SODIS antreiben, von solchen Interventionen, welche verhaltensändernde Faktoren beeinflussen und von den Variablen, die den Unterschied zwischen den verschiedenen Phasen des Änderungsprozesses ausmachen. Zusätzlich wird untersucht, ob das I-Change Model mit den Befunden zur Verhaltensänderung der durchgeführten 3jährigen Langzeit-Feld-Studie in Armenvierteln in Simbabwe übereinstimmt.

Die erste Untersuchung beschäftigt sich mit den Faktoren, die die Aufnahme von SODIS antreiben. Es konnte gezeigt werden, welche persuasiven Faktoren die frühe Verbreitung und Aufnahme von SODIS beeinflussen. Diese Faktoren sind in späteren Phasen des Verhaltensänderungsprozesses weniger bedeutsam. In einem nächsten Schritt wurden verschiedenen Verhaltensänderungsinterventionen analysiert und die erfolgreichsten der

genutzten Interventionen ermittelt. Zusätzlich konnte bestimmt werden, wie und mit Hilfe welcher verhaltensändernden Faktoren diese Interventionen Verhalten beeinflussen. Die dritte Untersuchung nutzte die Langzeitdaten, um verschiedene Nutzertypen zu ermitteln. So konnten neue Erkenntnisse darüber gewonnen werden, wie sich das Nutzungsverhalten über die Zeit entwickelt und was diese Veränderung bewirkt. Die vorliegende Dissertation integriert diese Analysen und ihre Befunde, um den stattfindenden Verhaltensänderungsprozess darzustellen, sowie die psychologischen Faktoren, die diese Veränderung bewirken. Es konnte gezeigt werden, dass die Resultate gut mit den theoretischen Annahmen des I-Change Modells übereinstimmen. Als Ganzes stärken die Befunde das Verständnis über die verschiedenen Phasen des Verhaltensänderungsprozesses und darüber, welche Faktoren in welcher Phase von Bedeutung sind. Diese Erkenntnisse werden genutzt, um Schlussfolgerungen darüber zu ziehen, wann welche Interventionen in einer Kampagne zur Verhaltensänderung genutzt werden sollten und warum.

Introduction

Background

Although clean water is a human right, 1.1 billion people still lack access to safe drinking water (World Health Organization [WHO], 2006a). Moreover, about 1.8 million people die from diarrhoeal illnesses every year (WHO, 2007). As these illnesses mainly result from a lack of safe drinking water, sanitation and hygiene - enabling access to safe drinking water could improve living conditions greatly and many deaths could be avoided. Boiling is one common method of treating unsafe water to avoid diseases; however, it uses a lot of natural and human resources, requiring fuel (wood or gas) as well as time and effort. A more sustainable way of treating water is solar water disinfection (SODIS), which utilises a waste product (used plastic bottles) and the sun to treat drinking water. In comparison to wood or gas for boiling or chemicals for disinfecting SODIS has incredibly low environmental impact.

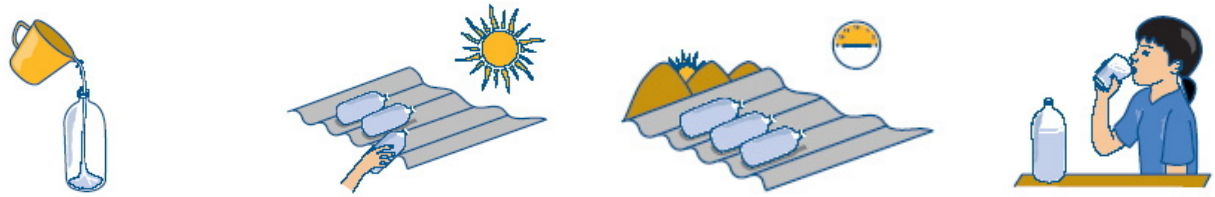
This paper examines the process by which people come to adopt SODIS and build up a habit of using it. Understanding this process reveals the factors that lead to the successful adoption and maintenance of SODIS usage. Identifying the relevant factors for the stages of the behaviour-change process enables the improvement of future campaigns and interventions for SODIS use and might find application in the promotion of similar health or sustainability innovations.

Introduction of Solar Water Disinfection

SODIS is a pro-poor household-based water treatment method. Polyethylene terephthalate (PET) bottles filled with water are exposed to sunlight for six hours (or two

consecutive days if conditions are more than 50% cloudy). Figure 1 shows the easy application of this method.

Figure 1: SODIS instructions



This procedure inactivates pathogens that are responsible for waterborne diseases such as diarrhoea, dysentery or cholera (Berney, Weilenmann, Simonetti, & Egli, 2006; Joyce, McGuigan, Elmore-Meegan, & Conroy, 1996; Wegelin, et al., 1994). The sunlight destroys these pathogenic microorganisms through two mechanisms, namely, UVA radiation (wavelength range: 320–400 nm) and increased water temperature (Meierhofer & Wegelin, 2002). The consumption of SODIS-treated water significantly reduces the diarrhoea rate in people who previously consumed untreated water (Conroy, Meegan, Joyce, McGuigan, & Barnes, 2001; Rose et al., 2006). However, Graf, Meierhofer, Wegelin and Mosler (2008) have shown that the protective effect of safe water on children under five years of age only occurred when a high percentage of the safe water was consumed.

The low cost of the application of SODIS is particularly important for those who lack access to other methods of water treatment due to their high cost (e.g., wood or fossil fuels) or non-availability of resources needed for their application. Moreover, by contributing to overall health, SODIS creates economic benefits by making available more working days and allowing money to be saved for medication (Meierhofer, 2007).

Not only is SODIS socially sustainable, allowing people to improve their living conditions independently of external help, it is also environmentally sustainable, as evidenced by

its win of the Energy Globe Award (Energy Globe, 2004). SODIS reuses PET bottles, which are otherwise a source of pollution, and saves firewood or gas that would otherwise be used for boiling water. Furthermore, SODIS helps to slow deforestation and does not contribute to air pollution; instead, it makes use of a sustainable energy source, namely, the sun.

In spite of these obvious advantages, SODIS use is usually not as widespread and instantly made use of as one would expect, considering the beneficial effects (Altherr, Mosler, Tobias, & Butera, 2008; Moser, Heri, & Mosler, 2005; Tamas, Tobias, & Mosler, 2009). Therefore, this study seeks to understand SODIS adoption and the behaviour-change process that leads to a long-term stable usage of SODIS and to identify appropriate, successful interventions and campaign designs.

Theoretical Background

According to Schwarzer (2004), correlating one or more constructs with the examined behaviour is one way to explain behaviour. Using this method, for example, high self-efficacy can be shown to be associated with low drug abuse. However, Schwarzer (2004) claims that this method is only a simple way of explaining behaviour and more profound analyses and explanations of behaviour change should be obtained with the help of models. There are different types of models. For example, health psychology differentiates between continuum models and stage models. Continuum models consider certain variables as predictors for certain behaviours so that, depending on the value of those variables, a person can be allocated to a certain point on a continuum of behavioural likelihood (Schwarzer, 2004). Popular continuum models include the Protection Motivation Theory (Rogers, 1983), the Theory of Planned Behaviour (TPB) (Ajzen, 1985), the Health Belief Model (HBM) (Becker, 1974) and the Social-Cognitive Theory

(Bandura, 1997). These models take into account different variables to explain the likelihood of a certain behaviour occurring at a given point in time.

In explaining a behaviour change process as in the case at hand, stage models have more explanatory power. Stage models consider different phases through which a person can pass during the process of changing behaviour. In such models, the behaviour change process is assumed to consist of successive steps, and subjects undergoing behaviour change move from one step to the next. Hence, people can be classified into stages or groups, depending on the attributes they show (e.g., whether someone who wants to quit smoking is only thinking about it or has already decided on a technique helping to quit). Another way to view stage models is to consider each stage as an individual continuum model such that various continuum models together constitute the stage model. Some well-known stage models include the Transtheoretical Model of Change (TTM) (Prochaska & DiClemente, 1983), the Precaution Adoption Process Model (Weinstein & Sandman, 1992) and the Health Action Process Approach (Schwarzer, 1992). Stage models are assumed to be heuristics that can help in choosing intervention strategies that foster behaviour change. Like other health behaviours examined with these models, SODIS adoption is a process of behaviour change. In this work, the process of SODIS adoption will therefore be explained in the theoretical context of stage models.

A range of stage models is available to explain preventive health behaviours like SODIS adoption. One stage model in particular integrates the two most widely used continuum models with a popular stage model: the Integrated Social Cognitive Model for explaining and changing behaviour (I-Change Model) (De Vries, 2004; De Vries, Mesters, van den Steeg, & Honing, 2005; De Vries, 2009) integrates the TPB (Ajzen, 1985), the HBM (Becker, 1974) and the TTM (Prochaska & DiClemente, 1983). With the help of these models, the I-Change Model differentiates between three main stages. The first stage focuses on awareness and information

factors, the second stage concentrates on motivation factors and the third is described as the actual action stage in which the behaviour is finally prepared and carried out. The awareness stage comprises the factors of knowledge, cues to action and risk perception, and the information factors of message, channel and source. The motivation stage consists of attitude (pros and cons, rational and emotional), social influences (norms, modelling, pressure) and efficacy (routine, social, situational, stress). Finally, the action stage features a process similar to that described in the TTM: precontemplation, contemplation, preparation, trial and maintenance.

We hypothesize that the SODIS adoption process fits these three stages quite well; for using SODIS requires a behaviour change process from drinking raw water or water treated by another method to using SODIS regularly. Furthermore, we believe SODIS use behaviour to require the same stages as other health behaviours, that is, becoming aware of or hearing about a health threat (awareness and information), developing the motivation to change the behaviour so that the health threat can be avoided (motivation) and practicing the behaviour (action). Since changing behaviour towards SODIS use requires people to be aware of the risk of waterborne diseases in untreated water, information dissemination is essential for creating awareness. Therefore, awareness and information dissemination should make up a large part of any newly beginning SODIS campaign. To analyse this starting point of the SODIS behaviour change process, the first stage of the I-Change Model will be used. Moreover, people can be motivated to use SODIS with the help of planned interventions. The impact of these interventions on certain factors like those used in the I-Change Model and derived from the TPB can be examined with the help of the second stage of the I-Change Model. Further, as has been proposed in the TTM, the actual change in behaviour occurs over certain stages. The SODIS behaviour implementation can be analysed with the help of these stages occurring within the third phase of the I-Change

Model. On account of all these reasons, we chose the I-Change Model as an adequate stage model for investigation of the behaviour change process behind SODIS adoption.

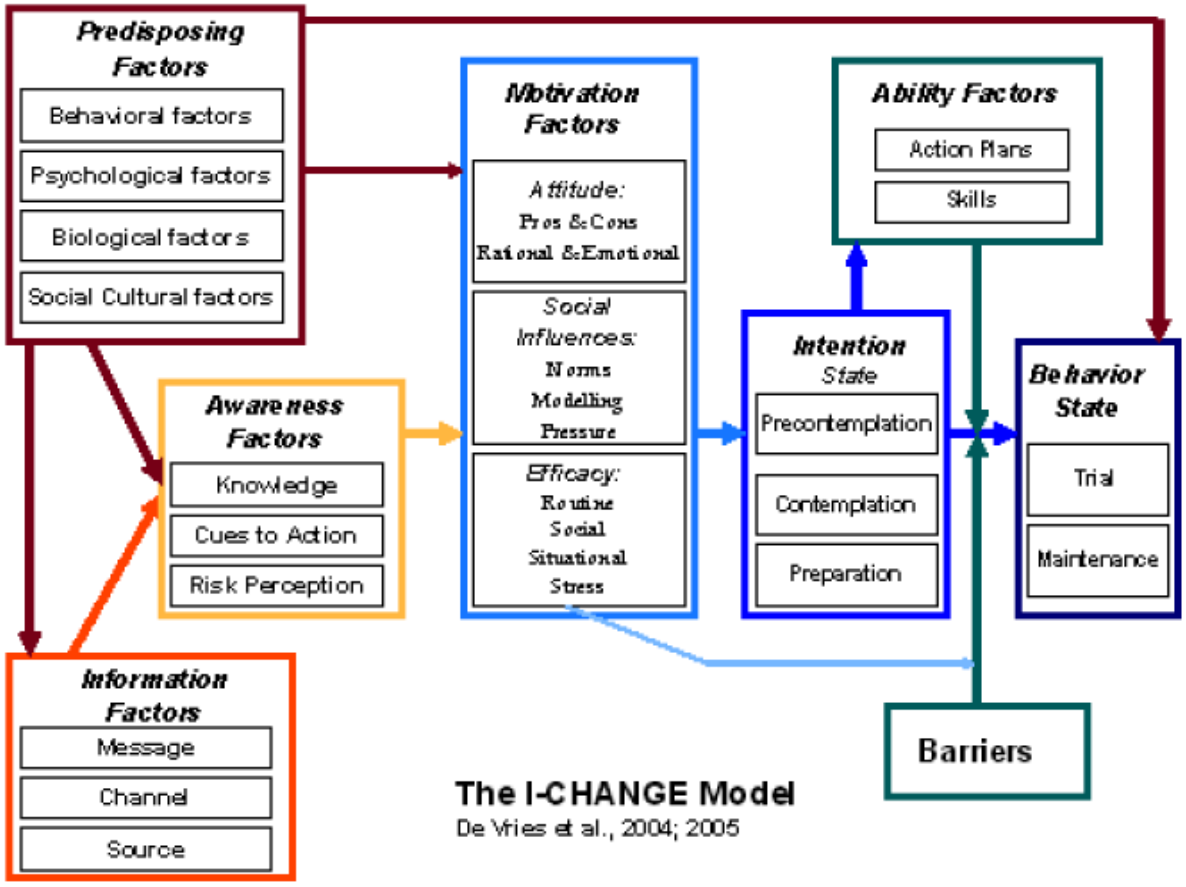
The I-Change Model was generated from the Attitude–Social influence–Self-Efficacy Model (De Vries, Dijkstra, & Kuhlman, 1988; De Vries & Mudde, 1998), which, in turn, was based on the TPB (Ajzen, 1985). The TPB contributed the factors of attitude, social norms (or influence), behavioural control (slightly altered to self-efficacy in the I-Change Model) and intention (the overall motivation stage in the I-Change Model). In addition, the I-Change Model takes into account the HBM (Becker, 1974) and the TTM (Prochaska & DiClemente, 1983). The HBM adds the factors 'susceptibility to disease' and 'perceived seriousness of disease' (taken together as risk perception in the I-Change Model), demographic variables, socio-psychological variables (both of which can be found as predisposing factors in the I-Change Model), cues to action (used as an awareness factor), perceived efficacy and control (both forms of self-efficacy) and barriers. The TTM provides the framework for the last stage of behaviour change as proposed in the I-Change Model; that is, the action stage consists of precontemplation, contemplation, preparation, trial and maintenance (where the TTM proposes precontemplation, contemplation, trial, maintenance and relapse). Further, De Vries et al. (2005) added the ability factors of action plans and skills (derived from implementation and goal setting theories; e.g., Gollwitzer & Schaal, 1998) and the information factors of message, channel and source (commonly found in communication and persuasion research; e.g., Petty & Cacioppo, 1986a). However, as persuasive communication is also mentioned as a cue to action in the HBM, it may have been through this model that persuasive factors found their way into the I-Change Model.

Figure 2 shows the current version of the I-Change Model as used in recent studies (e.g., De Vries, Mesters, van den Steeg, & Honing, 2005; Panday, Reddy, Ruiter, Bergstrom, & De Vries, 2007). The I-Change Model proposes three stages each identifying one main state in

the behaviour change process: awareness, motivation and action, with each stage being based on a different model. The awareness phase is mainly based on factors from the HBM and persuasion; the motivation phase is based on the TPB, and the action phase is based on the TTM and supplemented with factors derived from those in the HBM.

The I-Change Model has been tested with health behaviours, such as hereditary cancer (De Vries, et al., 2005), and with the background of tailoring health interventions and messages to people who are meant to adopt certain behaviours like physical activity (De Vries & Brug, 1999; Smeets, Brug, & De Vries, 2008). However, the widest application of the I-Change Model has been related to smoking (De Vries, et al., 1994; De Vries, Backbier, & Kok, 1995; De Vries, et al., 2003; Dijkstra, Mesters, De Vries, Van Breukelen, & Parcel, 1999). Recently, for example, certain factors from the I-Change Model were applied to smoking adolescents in South Africa (Panday, et al., 2007) to compare ethnic groups in terms of their smoking behaviour. The factors derived from the I-Change Model were predisposing factors, social influence, attitude, self-efficacy and intention. All used factors showed significant correlations to smoking behaviour, and each could differentiate between at least two of the three compared ethnic groups. Despite its relative youth, a significant amount of research is available on the I-Change Model; however, no publication exists that examines research on each stage of the model together. Therefore, the three studies at hand will be taken into account together to discuss their meaning for the I-Change Model.

Figure 2: I-Change Model (De Vries, 2004)



The complete I-Change model presented in Figure 2 consists of predisposing factors, awareness factors, information factors, motivation factors, intention states, behaviour states, ability factors and barriers. Predisposing factors, barriers, and ability factors will not be discussed in greater detail. The reasons for that will be given successively in the following sections. Awareness factors and information factors are equalled persuasion factors and discussed within the first study. Motivation factors have been derived from TPB and as such are analysed within the second study. Intention state and behaviour state have been taken from the TTM. The third study presented here is examining those steps or groups within intention and behaviour states which equal the TTM steps.

Following the arrows in the model, it is apparent that each stage leads on to other stages. The predisposing factors affect the information factors, the awareness factors, the motivation factors and the behaviour state. The effects of the predisposed factors will not be discussed in more detail because they will not be utilized in the following; neither will the ability factors (which affect the change from the intention state to the behaviour state) nor the barriers (which also affect the change from intention to behaviour state). Similarly, the effects from motivation factors to barriers and from the intention state to ability factors will not be discussed further. The information factors influence the awareness factors. For example, receiving a certain persuasive message can be a cue to action, something that makes the receiver of the message act in a certain way. The awareness factors have an effect on motivation factors. For example: What someone knows about an issue can shape that person's attitude about it and is part of the pros and cons a person can sum up to consider the issue. Motivation factors have an influence on the intention state. For example, having a lot of people in the immediate surrounding who think that a certain behaviour is appropriate can create the intention to act in that appropriate way. The arrow from intention state to behaviour state signifies that going from preparation to trial is the next step towards showing behaviour.

Awareness (on the left in Figure 2), as the first stage, contains predisposing factors, awareness factors and information factors. The predisposing factors will not be examined here in further detail because they are quite broad and therefore need to be examined independently. The other two types will be described in the following. Under awareness factors knowledge, cues to action and risk perception factor are grouped. The group of information factors consists of message, channel and source factor. The factor of knowledge refers to whether someone knows about something posing a health risk, that is, knowing about the background of illnesses. Cues to action are external influences that promote the desired behaviour, such as information or

persuasive communication (Becker, 1974). Risk perception refers to how someone perceives his or her risk of contracting an illness or condition. The information factors of message, channel and source refer to the classical persuasion factors of the attributes of the message (e.g., how convincing, understandable or long a message is), the channel or means of communication (e.g., via radio or newspaper) and the source of the information (e.g., how nice or influential the communicator of a message is perceived as being). All these factors play a role in raising awareness about a health issue in a target population, in knowing how to shape the information and in implementing what makes people receive this information in a more positive or more negative manner.

Persuasion research is concerned with the same issues described above. The term 'persuasion' refers to the application of deliberate communication with the aim of changing the opinion (and/or behaviour) of the recipient of the communication (Chaiken, Wood & Eagly, 1996). The first study that will be described here uses several persuasion factors to explain SODIS behaviour. Persuasion is employed as a framework because people need to first hear about the health risk and possible solutions, as well as be convinced about SODIS and changing their behaviour before the motivation and actions stages of the behaviour change process can be induced. Therefore, the first study presented here will be used to discuss the awareness stage of the I-Change Model. For Study 1, the I-Change Model provides factors from the awareness stage, which will be viewed as persuasion factors, since awareness factors were identified as being classically used in persuasion research. The following describes factors from the awareness stage of the I-Change Model and how they were translated into the factors from Study 1:

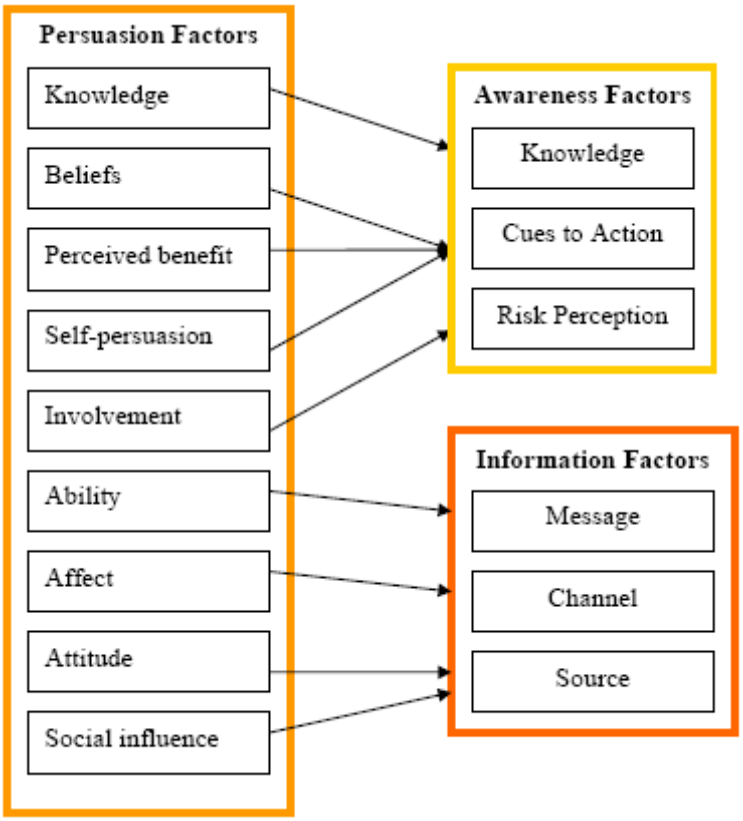
- Knowledge: These factors concern knowledge about SODIS and its connection with health.

- Cues to action: Since cues to action can be persuasive communication that aims at changing beliefs, the compatible factors from Study 1 are beliefs and perceived benefit. Self-persuasion can also be viewed as a cue to action, even though the persuasion here is not external, but internal.
- Risk perception: Study 1 uses involvement as the perceived need for water treatment. As such, it is comparable to the manner in which the risk of not treating water is viewed.
- Information factors: The information factors are merely indicated as message, channel and source. What lies behind these terms are their attributes. That is, it is not the message, channel or source that influences the awareness or attitude of a person, but the factors' attributes—how convincing, understandable or emotionally positive they are. For instance, one factor in Study 1 is ability, which refers to the understandability of the message. Another factor is affect, which represents how positively the message was viewed. Further, attitude and social influence are viewed in Study 1 as derived from information factors, even though the same terms exist in the motivation stage of the I-Change Model. Attitude is changed as a result of the attributes of the message, channel and source, while social influence is exerted by the source that provides the persuasive information about SODIS.
- Habit is a factor which is not included in the I-Change Model but has been added for the analysis of Study 1. For an explanation of why we used this

rather unusual factor in connection with persuasion, please see the section on persuasion factors in Study 1.

In the following figure, you can see how the persuasion factors used in study 1 relate to the factors used in the I-Change Model.

Figure 3: Persuasion factors (left) relating to factors of the I-Change



The second stage of the I-Change Model, motivation, is concerned with attitude, social influence and efficacy. This part of the model is derived from the Theory of Planned Behaviour (TPB) (Ajzen, 1985). Changes to the factors that constitute attitude, social influence and efficacy are assumed to change a person's motivation, or ultimately, intention to adopt a certain behaviour (De Vries, 2004). Attitude consists of the factors of pros and cons and emotional and rational attitude. Social influence contains norms, modelling and social pressure. Efficacy is divided into routine, social, situational and stress efficacy. These factors in the I-

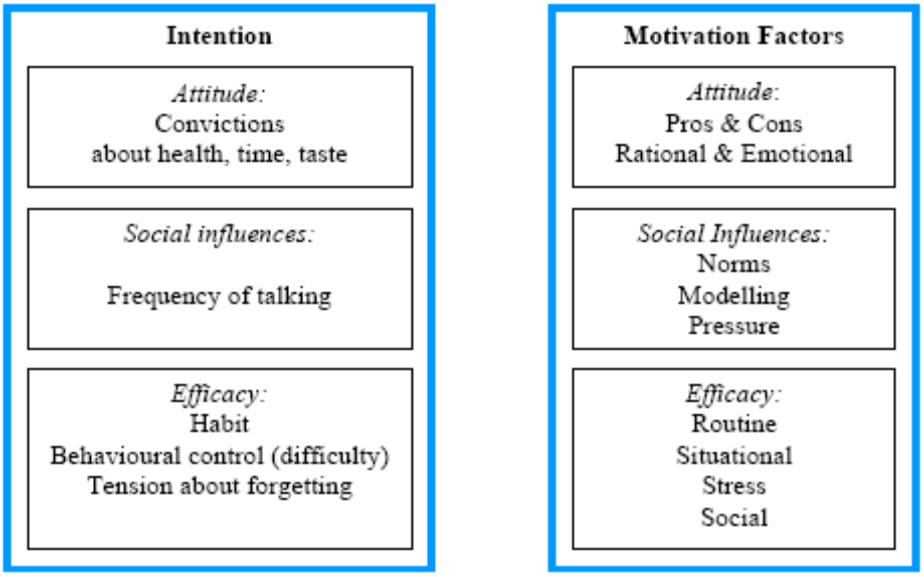
Change Model were derived from the TPB and either changed or complemented slightly. The same procedure was used in study 2 in the thesis at hand. Study 2 uses the TPB as its overall framework and then complements it with factors from the I-Change Model that are assumed to be relevant. As Study 2 examines how interventions for behaviour change can influence these factors, it will be used to discuss the motivation stage of the I-Change Model. The following explains how the factors of the I-Change Model relate to the factors of Study 2:

- Attitude: Attitude is assumed to consist of pros and cons in the I-Change Model; therefore, Study 2 uses convictions as a more detailed form of overall attitude. Convictions about SODIS-related topics such as taste or time represent the pros and cons of SODIS use. Similarly, what is termed knowledge in Study 2 can also be seen as a conviction, given the use of the question, "Does SODIS water make you healthier or less healthy?" That is, it queries a conviction about the healthiness of SODIS.
- Social influence: Subjective norm is a factor of Study 2 that is directly derived from the I-Change Model. Frequency of talking is used in Study 2 to represent the social pressure that is exerted by communicating about SODIS.
- Efficacy: Behavioural control or the perceived difficulty of using SODIS represents situational efficacy. A higher habit of preparing SODIS means that routine efficacy is given. Similarly, feeling a high tension when forgetting to prepare SODIS supports the development of routine efficacy.
- Motivation: Although motivation is not named explicitly as a factor but rather as a stage, intention (which consists of the same three factors—

attitude, social influence and efficacy or behavioural control—as motivation in the I-Change Model) was included in Study 2 because it is an essential factor in the TPB.

The following figure summarizes how the factors used in the I-Change relate to the factors examined in study 2.

Figure 4: TPB factors (left) relating to the motivation factors from the I-Change.

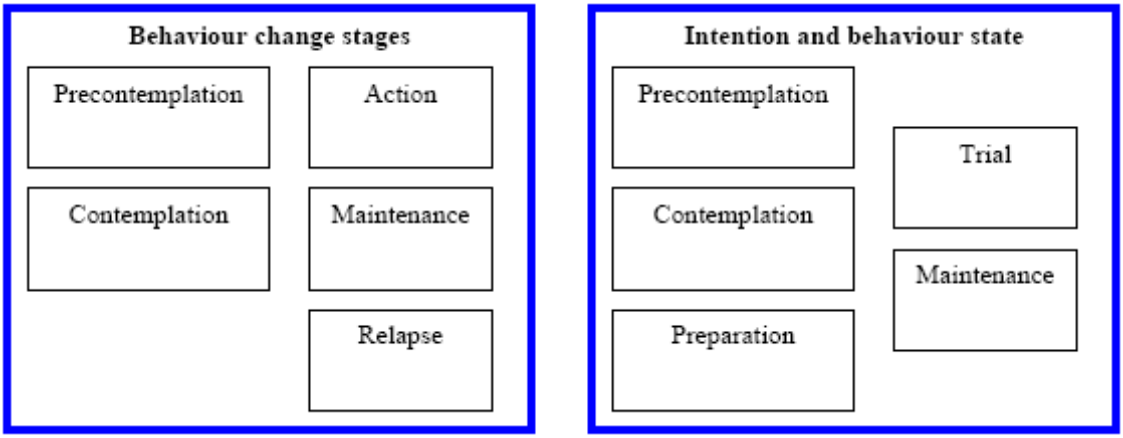


The third stage, action (on the right of Figure 2), is comprised of the process of actual behaviour change. While the first two stages are concerned with the predisposing factors that lead to an intention to change, this last stage involves the behavioural change that happens once the decision to act is made (De Vries, 2009). The Transtheoretical Model of Change (TTM) (Prochaska & DiClemente, 1983), the basis of the last stage of the I-Change model, explains the unfolding of this process. The third study presented here examines the different stages that describe SODIS users, employing the TTM as a framework for this analysis. Hence, Study 3 discusses the last stage of the I-Change Model and uses the same stages as proposed in the TTM: precontemplation, contemplation, action, maintenance and relapse. As mentioned previously, the

corresponding stages in the I-Change Model are precontemplation, contemplation, preparation, trial and maintenance, excluding relapse. Study 3 examines whether the stages of TTM adequately describe SODIS use or whether more or fewer stages are appropriate. To explore the differences between the stages, four factors are utilised that are derived from research on the TTM: need, attitude, intention and habit. For a detailed explanation of the choice of these factors for analysis, please see the introduction of Study 3.

The following figure shows how the factors analysed in study 3 and derived from TTM relate to the factors used in the I-Change.

Figure 5: Factors from TTM (left) compared to the I-Change factors.

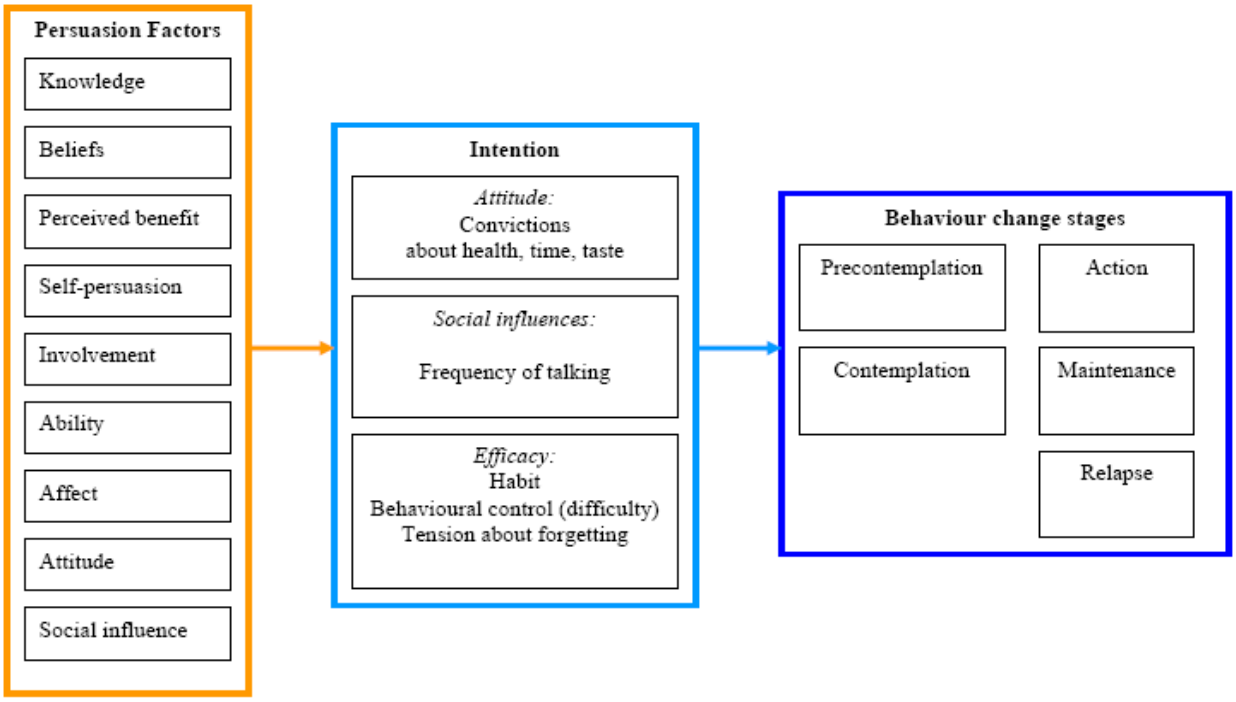


Additionally, the I-Change Model proposes predisposing factors, barriers and ability factors. The predisposing factors are introduced very broadly as behavioural, psychological, biological and socio-cultural factors. Here, these broad factors are not considered or analysed further because the focus lies on particular psychological factors rather than on less defined overall circumstances. Moreover, most demographic factors have been shown to not have a strong influence on SODIS use (Tamas, Tobias, & Mosler, 2009) and are thus neglected here. Similarly, barriers are not explained in depth in the I-Change Model, while ability factors are stated as consisting of action plans and skills. Although barriers and ability factors can be

important in explaining SODIS behaviour, they are viewed as accompanying factors in the research at hand. Some examples of barriers and ability factors are ability in Study 1 (which can be considered a skill; i.e., the skill to understand the message) and behavioural control in Study 2 (which can be considered both a barrier and an ability; i.e., feeling that preparing SODIS is too difficult or feeling able to prepare SODIS). Other examples of barriers and abilities that were mentioned or used in the research without explicit mention in one of the studies presented here include: implementation intention contracts (action plans) and bottle availability (a barrier, if not given). It is important to note that the test of the I-Change Model presented here is not a complete test of the overall model, but rather a test of the three main stages of behaviour change: awareness/information, motivation and action. Therefore, predisposing factors, ability factors and barriers are not discussed in detail here.

The following figure shows the changed I-Change Model using the factors that are being examined in the presented studies 1, 2 and 3. Those parts of the I-Change Model that are not being discussed in any of the three studies are not shown in the following figure.

Figure 6: I-Change matched with factors analyzed in the presented three studies



The three studies presented in this thesis each represent one stage of the I-Change Model. Each study focuses on one stage of change and investigates the processes happening in that particular stage. Taken together, a holistic picture can emerge about the processes occurring in each stage and the behaviour-change process in general. The first study presented here examines the adoption of SODIS from the perspective of persuasion, specifically, which persuasion factors contribute to SODIS adoption as well as which persuasion factors play a role in SODIS use. Since SODIS use is the action of performing the behaviour, it belongs to the action phase of the I-Change Model. The question that arises is whether persuasion (as a process of the awareness/information stage) also has an impact during the action phase. The second study concentrates on interventions and their impact on factors derived from the Theory of Planned Behaviour (Ajzen, 1985) and additional factors in part taken from the I-Change Model. This study analyses whether and in what manner the used interventions influence these factors and how these factors change over time. Finally, the third study uses the Transtheoretical Model of

Change (Prochaska & DiClemente, 1983) to examine the stages of action in SODIS use. This study explores the characteristics of users to determine whether the stages of action that are stated in the I-Change Model actually occur during SODIS use and which factors distinguish between those stages of action. Overall, each main stage of the I-Change Model is being explored through the use of a different study to clarify whether the stages do occur the way they are theoretically assumed and what processes take place within each stage exactly.

Research Questions

Referring to Study 1: Is persuasion present in the awareness stage of the I-Change Model? Does persuasion also occur in other stages?

Referring to Study 2: How do the interventions influence factors of the TPB and additional factors, as they are assumed in the I-Change Model and which factors are changed? How do these factors change with time and under the influence of interventions?

Referring to Study 3: Are the stages as assumed by the TTM or by the I-Change Model identifiable amongst SODIS users? Which factors differentiate between the identified stages?

Methods

General Overview

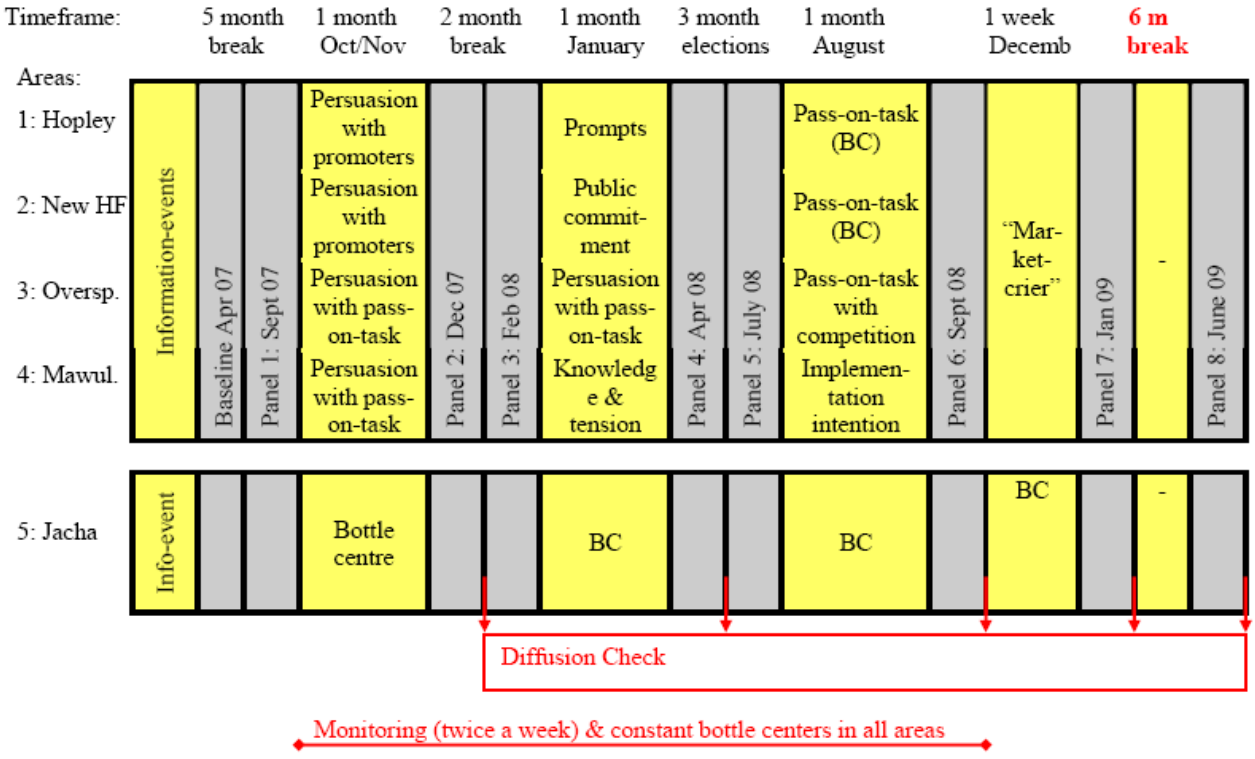
The research at hand is a longitudinal study over the course of two years and two months. All in all, 8 panel interviews have been carried out with the same subjects being interviewed at every panel plus an additional 100 subjects each at Panel 2, 3, 4, 6, and 7. (For more information on the exact number of people, please see "sample" in this chapter.)

The very first step of the study at hand was to implement SODIS information events (please see figure 8), so that at least some people would know about SODIS at the point of the baseline panel (it was sure that SODIS was not known in the target region beforehand and with the help of those information events, attitudes and thoughts towards SODIS could be analysed).

Figure 7: Information event introducing SODIS into the community

In April 2007, a baseline was carried out, which served to explore the target group, their circumstances, living conditions, water treatment behaviour and attitudes, to refine the questionnaire and to plan the first set of interventions. Before these interventions were implemented, panel 1 was carried out, so that the meantime self-dissemination of SODIS could be analysed. After that, four intervention phases alternated with panels, whereby each panel interview served to plan the next set of interventions. Two additional panels were inserted into this design, because at one point of time there was a delay due to difficult living circumstances in Zimbabwe in general and between April and July 2008, while presidential elections were taking place, all NGO work (including our kind of research work) was banned by the government. The overall research design is visualized with the help of figure 8.

Figure 8: Design of longitudinal research at hand



As can be seen in figure 8, additionally to the panel interviews, diffusion check interviews and monitoring interviews have been carried out. Diffusion check and monitoring

procedures will not be discussed here in detail. Diffusion Check is a way of surveying spatial change in the density of adoption by inhabitants of the intervention areas and around the intervention areas. From September 2007 to June 2009, 5 Diffusion Checks have been carried out, with a total of about 6000 people interviewed with a short 10 minute interview. Monitoring has also been done with short interviews of about 10 to 15 minutes (panel interviews take about 45 to 60 minutes) that were carried out every third day with the same group of 250 subjects. That way, short time changes in behaviour can be analysed with modelling and simulation. Because these kinds of analyses are very different and no results have been published yet, they will not be discussed further.

Neither will the results of Panel 8 be discussed because its analysis is being done while the publication at hand is being prepared. The results of Panel 8, more details of single panels and analyses and conclusion can be found in different publications, such as a report about adoption and diffusion factors (Kraemer, 2009) or various reports which can be found on www.sodis.ch (SODIS Reference Center, 2009) and on www.rcsi.ie/sodis/index.htm (Royal College of Surgeons, 2009).

Research Area

The field research was carried out in informal settlements in high-density areas around Harare. Harare is the capital of Zimbabwe, which currently has the highest inflation rate in the world and is thus economically very unstable. The municipal infrastructure, including the water supply and sanitation is good, but the high-density areas and so-called informal settlements that grew after a governmental relocation of city residents in 2005, such as Epworth and Hopley Farm, widely lack access to sanitation and safe drinking water (Amnesty International, 2006). Epworth has about 350.000 inhabitants, Hopley Farm about 60.000; no official numbers are

available because of the informal nature of most of the settings. This is also the reason for quite some movement in and out of these areas.

Figure 9: Example for housing situation in high-density area, Hopley Farm

In general, only 47% of the 13 million inhabitants of Zimbabwe in the rural areas have access to improved sanitation, 72% have access to improved drinking water sources and the mortality rate of children below five is 10%. Of these, 12% die from diarrhoeal diseases (WHO, 2006a). These numbers are much higher in the high-density areas and increase rapidly with the deteriorating situation in Zimbabwe. As most people get their water from unsafe water sources such as (unprotected) wells, as secondary contamination is high and most people do not treat their water, there is great potential for a water treatment technique like SODIS (Murinda & Kraemer, 2008).

Procedure

Data was obtained by conducting structured interviews in the households of the interviewees. People took part voluntarily in this study and without receiving anything for it.

They were chosen randomly, by means of Random-Route-Sampling (Hoffmeyer-Zlotnik, 2003). That means the interviewers (who were local citizens from around Harare and chosen on behalf of their qualifications and work experience) went to every third household on their way through their assigned area. That way, 10 interviewers completed 5 to 8 interviews a day, each one taking about 45 minutes. Interviews were held in Shona, the main native language of Zimbabwe. The trained interviewers asked each question on the questionnaire and classify the answers they received to the answer categories on the questionnaires. If they were not sure how to classify, interviewers would ask the interviewee one or several questions to make a classification possible. Figure 10 shows a typical interview situation.

Figure 10: Structured face-to-face interviews in Epworth

The baseline interviews based on our questionnaire took place in May 2007, two to three weeks after an information event about SODIS in the respective areas. People were informed about these information events by local leaders and through posters. Since some people had heard about SODIS like this, the questionnaire started with questions about SODIS use

which led to a section with questions about details of its use for those who used SODIS or to general questions about drinking water, water sources, knowledge and convictions related to water treatment for those who did not use SODIS. If people had a preferred method of water treatment, they answered the next section about this method, and were then asked general questions about health and washing hands. The next step was for the interviewers to provide standardized information about SODIS to the interviewees. That made sure that everyone could answer the next part, namely general questions about SODIS. Sections about communication, motivations, habits and network formed the last part of the questionnaire (please see attachment for the questionnaire).

Depending on the experiences with the baseline interviews, the following panel interview questionnaires were revised. Panel 2 to panel 8 only changed in single questions that were added due to new hypotheses and findings. As visualized in figure 8, the baseline interviews were taking place in April 2007, followed by a five-months-break, which was used to develop the first set of interventions, to build up and train a team to disseminate these interventions. Before starting this first intervention phase, panel 1 was carried out to check for time effects. Panel 2 was carried out in December 2007, after the first intervention phase. Heavy economical problems of the country lead to a two-months-break before the second set of interventions could be carried out, therefore panel 3 was carried out to check for time effects. Panel 4 was carried out in April 2008, after the second intervention phase, followed by elections with heavy upheavals which lead to a three-months-break, after which Panel 5 was carried out to check for time-effects. Panel 6 and 7 were carried out after the third and fourth intervention phase. A six-months-break before panel 8 allows checking for long-term-effects in the behaviour change and maintenance process. The different studies in the thesis at hand are concerned with certain aspects of the overall process and

therefore different panels were chosen to answer the respective questions. The used interventions are explained when used in the respective study.

Sample

At the baseline, rejection rate of the households that were asked to participate was 5%; 926 people were asked to participate, 48 people refused, which leaves a final figure of N = 878 subjects for the baseline interviews. The person in the household responsible for the drinking water of the members of the household was interviewed. All of these 878 subjects were supposed to be interviewed at the following panels. Some could not be found in single panel interviews, while n = 61 (7.1%) dropped out altogether. In panel 1, n = 103 (11.9%) were not taking part in the interviews, in panel 2, n = 83 (9.6%), in panel 3, n = 61 (7.1%), in panel 4, n = 89 (10.3%), in panel 5, n = 116 (13.4%), in panel 6, n = 197 (22.8%) and in panel 7, n = 125 (14.5%). The interviewers were advised to interview 100 additional subjects at each point of time from panel 3 on, to be able to compare for interview effects. In panel 3, n = 139 new subjects were interviewed, in panel 4, n = 162, in panel 5, no new subjects were interviewed, in panel 6, it was n = 126 and in panel 7, n = 96.

The following information about the sample is retrieved from the baseline study. The participants in this field research were N = 878 inhabitants of high-density areas, N = 364 from Hopley Camp Farm, southwest of Harare, and N = 514 from Epworth, southeast of Harare. The interviewees were N = 802 (91%) women and N = 76 men. The mean age was M = 34, the mean number of years of education were M = 8 years, the mean income was M = 400.000 Zim$ (about 15 US$ at that time) per month per household (M = 4.5 persons per household). This means that on average, people in the research areas live far below the poverty line of 1US$ per day. Most people in the project areas are unemployed (24%), vendors (20%), informal traders

(11%) or housewives (17%). On average, there is one child ($M = 0.9$) below five years of age in each household.

Questionnaire

The questionnaires which were used in the research at hand were comprised of five main sections: Section 1 included demographic information, information about the household and general questions about drinking water. Section 2 was comprised of questions about different aspects of SODIS: knowledge, use, communication, persuasion, specific reasons for use / non-use and convictions. Sections 3 asked more specific questions to SODIS use, like observations about the used bottles, circumstances of SODIS preparation, affective connotation of the preparation, specific experiences, habits, forgetting and intention. Section 4 was concerned with giving the basic information about SODIS, so that section 5 could be answered by all interviewees. Section 5 included general questions about SODIS and other drinking water, attitudes, questions about health and health convictions, general questions about communication behaviour and attributes, social influence and questions about attributes of the SODIS campaign.

Next to some open questions, most questions were answered with 5-point-likert scales in case of unipolar variables and 9-point-likert scales in case of bipolar variables. Very few questions had different answer scales, where the possibilities named before were not applicable (like when more than one option could be chosen, for example: “Who told you about SODIS” with the answer possibilities: Promoters / health workers / neighbours / friends / other). Unipolar variables were coded from 0 to 1 (0 - 0.25 - 0.5 - 0.75 - 1) and bipolar variables from -1 to 1 (-1 - -0.75 - -0.5 - -0.25 - 0 - 0.25 - 0.5 - 0.75 - 1), with 1 being the option that supports SODIS use the most and 0 or -1 being the option that supports SODIS use the least. For example, the answer scale for the question: “Do you think drinking SODIS water can make you healthier or less

healthy" ranged from -1 = much unhealthier to 1 = much healthier, whereby the belief that SODIS makes you much healthier supports SODIS use and thus is coded with 1 and the belief that SODIS makes you much unhealthier does not support SODIS use and thus is coded -1.

Since each questionnaire was comprised of 225 questions, not all questions could be included into every analysis. Therefore, the variables and questions that were used for the single analysis are explained in the respective chapter.

Study 1:

Persuasion Factors Influencing the Decision to Use Sustainable Household Water Treatment

Abstract

Solar water disinfection (SODIS) is a sustainable water treatment method. With the help of the sun and plastic bottles, water is treated and illnesses prevented. This paper aims to identify the factors influencing SODIS uptake, that is, why someone may become a SODIS user. This uptake decision can be influenced by persuasion. From behaviour theory, variables are recognized which have been proven to influence intention and behaviour and simultaneously can be influenced by persuasion. N = 878 structured interviews were conducted in a field study in Zimbabwe. Linear and binary logistic regressions showed that several of the initially proposed persuasion variables have significant influence. Persuasion factors have a stronger influence on the uptake of SODIS use and on intention to use SODIS in the future than on the amount of SODIS water consumed. Ideas are presented for using the effective variables in future SODIS campaigns and campaigns in other fields.

Key words: Intervention, SODIS, solar water disinfection, behaviour change, campaign, persuasion, convictions

Introduction[1]

Although clean water is a human right, 1.1 billion people still do not have access to safe drinking water (WHO, 2006b). About 1.8 million people die from diarrhoeal illnesses every year (WHO, 2007). These illnesses are mainly due to a lack of safe drinking water, sanitation and hygiene. This means many deaths can be avoided and living conditions improved by enabling access to safe drinking water. Boiling water is one common method of treating unsafe water to avoid diseases. However, it uses a lot of natural and human resources, requiring fuel (wood or gas) as well as time. Solar water disinfection (SODIS) is a way of treating water with the help of the sun and (used) plastic bottles that is more socially and environmentally sustainable. It uses a waste product (used plastic bottles) and the sun to treat drinking water instead of using wood or gas for boiling or chemicals for disinfecting.

SODIS is a pro-poor household-based water treatment method that uses transparent plastic bottles to disinfect the water with the help of the sun. PET bottles filled with water are exposed to sunlight for six hours (or two consecutive days if it is more than 50% cloudy). This procedure inactivates pathogens that are responsible for waterborne diseases like diarrhoea, dysentery or cholera (Joyce, McGuigan, Elmore-Meegan, & Conroy, 1996; Berney, Weilenmann, Simonetti, & Egli, 2006). The sunlight destroys these pathogenic micro-organisms through two mechanisms, namely UV-A radiation (wavelength 320-400nm) and increased water temperature (Meierhofer & Wegelin, 2002). Disease incidence and mortality rates can thus be reduced, especially for vulnerable groups like the elderly, children or HIV-infected persons (Conroy, Meegan, Joyce, McGuigan, & Barnes, 2001; Graf, Meierhofer, Wegelin, & Mosler, 2008). This is particularly important for those who cannot afford to treat their water by other

[1] This study is available as publication: Kraemer, S. M., & Mosler, H.-J. (2010). Persuasion Factors Influencing the Decision to Use Sustainable Household Water Treatment. *International Journal of Environmental Health Research*, *(20)*1, 61-79.

means, because wood, gas or chemicals are too expensive. By contributing to overall health, SODIS also creates economic benefits by making more working days available and saving money for medication.

SODIS is not only socially sustainable, giving people the chance to improve their living conditions independently of external help, but also environmentally sustainable, as the winning of the Energy Globe Award shows (Energy Globe, 2004). PET bottles, which are otherwise only a source of pollution, are re-used, and firewood or gas, which would otherwise be used for boiling water, is saved. Deforestation is slowed down and air pollution avoided; instead, a sustainable energy source, namely the sun, is used.

In spite of all these obvious advantages, SODIS usually encounters a slower and more limited uptake than one would expect (Heri & Mosler, 2008; Moser, Heri, & Mosler, 2005; Moser & Mosler, 2008). The reasons for this are still not fully understood. In order to run more successful dissemination campaigns in the future, it is important to know which factors contribute to a fast uptake of SODIS. There is consequently a need to analyse how people can be convinced of this sustainable innovation. Since doubts about the effectiveness of such a simple method as SODIS is may exist (Meierhofer & Wegelin, 2002) persuasion of its advantages would be necessary. It is possible to convince a person of adopting an innovation, e.g. a water treatment method, by persuading that person about its advantages. Persuasive communication is deliberately used to influence the attitudes and therefore the behaviours of the recipients of arguments (Chaiken, Wood, & Eagly, 1996). Thus, it should be possible to influence the uptake of SODIS with the help of persuasion. To study this process, we will identify the factors that may be changed by persuasion and simultaneously influence intention and use of SODIS. This approach will allow us to identify the factors on which a campaign should concentrate.

Persuasion Factors

Persuasion has been studied extensively and in great detail (Chaiken, Wood, & Eagly, 1996; Murphy, 2001; Petty & Cacioppo, 1986a; Petty & Wegener, 1999; Weisbuch, Deffuant, & Amblard, 2005). Some of the factors that are being researched in persuasion research also proved to explain behaviour in well-known behavioural models like the health belief model (e.g. Janz & Becker, 1984; Schwarzer, 2004) or the theory of planned behaviour (Ajzen, 1991). The following variables are those variables from these models that have been used in persuasion research so far.

Involvement: The first factor to have an influence on behaviour is the involvement of the recipient. Involvement, which is a common construct in persuasion research (Johnson & Eagly, 1989), means that a topic is viewed as belonging to the self. It has been shown that involvement has an influence in persuasion. For example, a TV show that influenced the feeling of involvement showed the direct impact of involvement on the behavioural intention to donate corneas (Bae, 2008). Thus, it is hypothesized that the higher a person's involvement, the more likely he or she is to be a SODIS user and the more SODIS water he or she will drink and intend to drink.

Attitude: Attitude is a variable that is widely used, in behaviour models (e.g. Ajzen, 1991) as well as in persuasion research (Petty & Cacioppo, 1986b). Attitude can be described as a tendency to react to something with like or dislike (Eagly & Chaiken, 1995). Petty and Cacioppo (1986b) found that an induced attitude change about using different kinds of razors also changed the behavioural intention to buy the corresponding product. The extent to which attitude and intention changed due to argument quality varied with cognition intensity, but the correlation between them remained significant (Petty & Cacioppo, 1986b). Two other persuasion studies, about bus use and organ donation, also found this relation between attitude change and the

corresponding behaviour (Bae, 2008; Beale & Bonsall, 2007). Therefore, the more positive the attitude towards SODIS, the more likely and the higher the intention to use SODIS and the corresponding behaviour.

Habit: Habits are routines of behaviour that are repeated frequently and occur without thinking consciously (Bargh & Chartrand, 1999). Habits have proven to influence behaviour, amongst others through persuasion. Beale and Bonsall (2007) found that the previous behaviour and habitual disposition of potential bus users played a significant role in differentiating between those whose behaviour could be changed through persuasion and those whose behaviour did not change. That means that SODIS users with a higher habit to use SODIS should have a higher consumption of SODIS-treated water.

Affect: This variable refers to the experience of feeling or emotion (Blechman, 1990) and emotions were found not only to facilitate persuasion but also to influence (in this case political) behaviour (Brader, 2005). In another study, possible cornea donors were influenced affectively, with an indirect effect on behavioural intention (Bae, 2008); other findings show that behavioural intention can even be directly influenced by the kind of feeling induced (Rucker & Petty, 2004). Rucker and Petty (2004) induced sad and angry states to determine whether subjects preferred active (angry participants) versus passive (sad participants) holidays. This indicates that a more positive affect towards SODIS should result in a higher likelihood of being a SODIS user, a higher intention to use SODIS and higher SODIS consumption by SODIS users.

Knowledge: Knowledge is known as an influential factor in persuasion research (e.g. Tormala & Petty, 2007). A meta-analysis of condom use (Albarracin, et al., 2003) showed that next to (attitudinal) information, knowledge about behavioural skills led to an increase in behaviour. It is therefore hypothesized that better knowledge about why SODIS should be used increases the likelihood of using it as well as the intention to use it and its consumption.

Beliefs: Most persuasion research is designed to change beliefs, therefore these are one of the most important factors to examine. In a study of patient behaviour in relation to medication (Jalnawala & Wilkin, 2007), beliefs were found to be influenced by persuasion (and different argument types) as well as to influence the intention to ask for a certain medication. In the present study, positive beliefs about how much SODIS costs and how much time it takes should lead to more SODIS consumption and the belief about how healthy SODIS is to more SODIS consumption, a higher intention and more SODIS users.

Perceived benefit: Perceived benefit plays an important role in persuasion. People are more easily persuaded when they see a good cost-benefit ratio for themselves; perceived negative consequences are viewed rather critically (Martin, Hewstone, & Martin, 2003). Therefore, messages focussing on the benefit of a behaviour (gain-framed messages) are more persuasive (Rivers, Salovey, Pizarro, Pizarro, & Schneider, 2005). These findings agree with the results of an experiment with beach-goers whose intentions and behaviour concerning sunscreen-use were changed more effectively by a gain-framed message than a loss-framed one (Detweiler, Bedell, Salovey, Pronin, & Rothman, 1999). Thus, when people think that SODIS is worth more than it costs - that is, when they see a positive cost-benefit ratio - they will be more likely to become SODIS users, SODIS users will drink more SODIS, and the intention to use SODIS will be higher.

Ability: The better a person can process and understand incoming information, the more persuasive is that information (Pierro, Mannetti, Erb, Spiegel, & Kruglanski, 2005). Ability is an important factor in persuasion research and determines, which route to persuasion is taken (Chaiken, 1980). Distracting subjects limits their ability to process information while giving them more time to think about a message enhances it (Albarracin & Wyer, 2001). Manipulating distraction and processing times was found to have various impacts on the intention to vote for

comprehensive exams at the subject's university as well as on the actual voting in an artificial situation (Albarracin & Wyer, 2001). SODIS use will be more frequent and more likely and intention stronger for subjects with a better ability to process information.

Social influence: Social influence (or subjective norm) is used as a proven factor in the Theory of Planned Behaviour (Ajzen, 1991), but also in persuasion research (e.g. Cialdini & Trost, 1998). Persuasion through social influence is more effective when more people share the same opinion (Erb, 1998) and when other people are models for certain behaviours (Cialdini & Trost, 1998). As regards social influence, persuasion takes place indirectly, via social pressure, as in the case of young people from Ireland who were influenced to start smoking by peer pressure (Stewart-Knox, et al., 2005). Therefore, it is hypothesized that the more people someone knows who use SODIS, the more likely is that person to use SODIS and the higher its consumption and the intention to use it.

Self-persuasion: Anyone can be influenced by self-persuasion. It is thus an interesting topic in persuasion research (Aronson, 1999). Self-persuasion occurs when someone talks about a topic; the point of view which they communicate has a persuasive influence on them (Frey & Gaska, 1993). Thus, by talking about a topic, self-persuasion has a powerful and long-lasting effect on attitudes and behaviour (Aronson, 1999). So the more someone talks about SODIS, the higher his/her intention to use SODIS, the likelihood to be a SODIS user and for users to drink more SODIS.

There are additional widely-used factors like self-efficacy or perceived behavioural control, which are being used in other well-known behavioural models, like the protection motivation theory or the health belief model (for an overview, please see Prentice-Dunn & Rogers, 1986). However, these factors have not yet been linked to persuasion research. That is why they will not be included in the analysis at hand.

For the persuasion variables that have been identified from behaviour models and persuasion research (involvement, affect, attitude, habit, knowledge, perceived benefit, beliefs, social influence, self-persuasion), it is hypothesized that the higher (or more positive) they are, the more likely someone is to be a SODIS user and the more SODIS water he/she consumes. Many studies of persuasion and behaviour change examine the intention to do something along with or instead of the behaviour (e.g. Bassili, 1996; Lewis, Watson, & Tay, 2007). Also, in the present study, the intention to use SODIS should be proportional to the magnitude of the identified persuasion variables.

(I) The intention to use SODIS (for non-users and users separately) is predicted by the identified persuasion variables.

(II) The higher (or more positive) the identified persuasion variables, the more SODIS-treated water does a SODIS user drink.

(III) The higher (or more positive) the identified persuasion variables, the more likely someone is to be a SODIS user.

The denoted variables have been chosen because they have proven to be important in persuasion research. Some of the chosen variables are also widely used in behaviour models. These variables have shown to influence behaviour as well as the intention. Therefore, it shall be shown that the persuasion variables influence behaviour and intention. However, SODIS behaviour can be divided into two parts: the uptake and the amount of SODIS water consumed. Uptake means that someone decides to be a SODIS user, but it does not specify, how much SODIS water (as part of the overall drinking water) someone consumes. Thus, both options are being analysed.

Besides examining the named questions, this paper aims to use these findings to develop a campaign with persuasion strategies that suits the situation and needs of the people it is

meant for. Designing one such campaign can create a model for and an example of how to design other interventions with persuasion strategies.

Methods

Research Area

The field research was carried out in informal settlements in high-density areas around Harare. Harare is the capital of Zimbabwe, which currently has the highest inflation rate in the world and is thus economically very unstable. The municipal infrastructure, including the water supply and sanitation is good, but the high-density areas and so-called informal settlements that grew after a governmental relocation of city residents in 2005, such as Epworth and Hopley Farm, widely lack access to sanitation and safe drinking water (Amnesty International, 2006). Only 47% of the 13 million inhabitants of Zimbabwe in the rural areas have access to improved sanitation, 72% have access to improved drinking water sources and the mortality rate of children below five is 10%. Of these, 12% die from diarrhoeal diseases (WHO, 2006a). These numbers are believed to be higher in the high-density areas and to increase rapidly with the deteriorating situation in Zimbabwe. As most people get their water from unsafe water sources such as (unprotected) wells, as secondary contamination is high and most people do not treat their water, there is great potential for a water treatment technique like SODIS (Murinda & Kraemer, 2008).

Procedure

Data was obtained by conducting structured interviews in the households of the interviewees. People took part voluntarily in this study and without receiving anything for it. They were chosen randomly, by means of Random-Route-Sampling (Hoffmeyer-Zlotnik, 2003). That means the interviewers (who were local citizens from around Harare and chosen on behalf

of their qualifications and work experience) only went to every third household on their way through their assigned area. That way, 10 interviewers completed 5 to 8 interviews a day, each one taking about 45 minutes. Interviews were held in Shona, the main native language of Zimbabwe. Rejection rate of the households that were asked to participate was 5%; 926 people were asked to participate, 48 people refused, which leaves a final figure of $N = 878$ subjects. The person in the household responsible for the drinking water of the members of the household was interviewed.

The interviews based on our questionnaire took place in May 2007, two to three weeks after an information event about SODIS in the respective areas. People were informed about these information events by local leaders and through posters. Since some people had heard about SODIS like this, the questionnaire started with questions about SODIS use which led to a section with questions about details of its use for those who used SODIS or to general questions about drinking water, water sources, knowledge and convictions related to water treatment for those who did not use SODIS. If people had a preferred method of water treatment, they answered the next section about this method, and were then asked general questions about health and washing hands. The next step was for the interviewers to provide standardized information about SODIS to the interviewees. That made sure that everyone could answer the next part, namely general questions about SODIS. Sections about communication, motivations, habits and network formed the last part of the questionnaire.

Sample

The participants in this field research were $N = 878$ inhabitants of high-density areas, $N = 364$ from Hopley Camp Farm, southwest of Harare, and $N = 514$ from Epworth, southeast of Harare. The interviewees were $N = 802$ (91%) women and $N = 76$ men. The mean

age was $M = 34$, the mean number of years of education were $M = 8$ years, the mean income was $M = 400.000$ Zim$ (about 15 US$ at that time) per month per household ($M = 4.5$ persons per household). This means that on average, people in the research areas live far below the poverty line of 1US$ per day. Most people in the project areas are unemployed (24%), vendors (20%), informal traders (11%) or housewives (17%). On average, there is one child ($M = 0.9$) below five years of age in each household.

Questionnaire

Behaviour: Two questions are asked to assess SODIS behaviour - one for determining the number of SODIS users (uptake) and one for the amount of SODIS water used. (1) Uptake: "Are you doing SODIS?" identifies SODIS users. This question has four possible answers: am doing SODIS regularly / have tried SODIS and am doing it sometimes / have tried SODIS but stopped / am not doing SODIS. Thus, SODIS users are those who are doing SODIS regularly or sometimes and SODIS non-users those who do not do SODIS. The decision whether someone is a SODIS user will also be referred to as "uptake" in the following. (2) Amount of SODIS water consumed: The amount of SODIS water one household drinks per day is assessed with "How many litres of SODIS does your family drink per day?" with an open answer. Together with questions about the amount of liters of other kinds of water consumed, a percentage of SODIS water of the overall drinking water can be calculated.

Intention: The intention to do SODIS was surveyed using the question "Will you be doing SODIS regularly in the next two weeks. Four answers were possible: very probable / probable / slightly probable / not probable.

Involvement: The survey question was "Do you see a need for water treatment?" Answer categories are: very much / much / slightly / not at all.

Attitude: Attitude is examined with "Do you think it is good or bad to do SODIS?" with the answers in seven steps: very good / good / a little bit good / neither good nor bad / a little bit bad / bad / very bad.

Habit: Since habits are routines of behaviour, that are executed automatically, without thinking, strong habits should not be forgotten easily (Tobias, 2009). Thus, habit strength is measured here with "How often does it happen that you intend to do SODIS and then forget to do so?" Answers were given in four steps: (almost) always / often / rarely / never.

Affect: The question for affect is "How do you feel about SODIS?" with an answer category in seven steps: very positive / positive / slightly positive / neither positive nor negative / slightly negative / negative / very negative.

Knowledge: Knowledge about bacteria was surveyed with two questions: "Are there any problems with the quality of your drinking water?" Answer categories: knows about contamination and the solutions (water treatment, hygiene) / does not know about bacterial contamination, but knows solutions / knows how bacterial contamination happens and the health problems / knows problems about bacterial contamination, details / knows of the problems about bacterial contamination, but no details / knows some problems, but not related to bacterial contamination / does not know any problems.

Beliefs: Several beliefs are analyzed: about time consumption, about expenses and about the healthiness of SODIS. Conviction as regards time consists of the question "How time-consuming is it to treat your water with SODIS?" (Answers: very time-consuming / time-consuming / slightly time-consuming / not time-consuming). Conviction as regards money is asked with "How expensive is it to treat your water with SODIS?" (Answers: very expensive / expensive / slightly expensive / not expensive). Conviction as regards health is measured with "Do you think that drinking raw water makes you healthier or less healthy?" (Answers: much

healthier / healthier / slightly healthier / neither healthier nor unhealthier / slightly unhealthier / unhealthier / much unhealthier).

Perceived benefit: The question for perceived benefit was "Do you think it is worth it to do SODIS?". The range of answers was: it is worth a lot more than it costs / it is worth more than it costs / it is worth slightly more than it costs / it is worth the same as it costs / it costs slightly more than it is worth / it costs more than it is worth / it costs a lot more than it is worth.

Ability: Ability in the persuasion process can either be measured with the amount of distraction present at the time of information or with the amount of time the receiver of the information has to process the information. In the field, it is extremely difficult to know how much distraction was present when the information was disseminated. Therefore, ability is assessed with the time a person has to process it and the question: "Had you heard about SODIS before this interview?" (Answers: yes / no). People who had heard about SODIS before the interview had more time to think about it than those who were told about SODIS at the interview.

Social influence: Social influence was surveyed with "How do other people think about you when you do SODIS?" Answers were: very positively / positively / slightly positively / neither positively nor negatively / slightly negatively / negatively / very negatively.

Self-persuasion: Since talking about a topic is a means of self-persuasion, the question used here was: "How often do you talk about water treatment, health and hygiene with others?" Possible answers were: every 1 to 3 days / every week / every 2 weeks / every 3 weeks / every month / less often than every month / never.

Results

Data from a total of $N = 878$ subjects were utilized for analysis. These subjects can be split up into users ($n = 95$), and non-users ($n = 783$). Overall, the subjects gave very positive

replies to SODIS (see Table 1): of all the subjects (Table 1, upper three parts), 93% said they would probably or very probably do SODIS in the next two weeks. 96% would probably or very probably talk about SODIS in the next two weeks. 95% have a positive or very positive attitude, and 91% a positive or very positive affect towards SODIS. 76% think that SODIS costs nothing. 62% think that drinking raw water can make them much unhealthier and that drinking SODIS water can make them much healthier. 33% think that other people would think neither positively nor negatively about them if they did SODIS. 57% have little knowledge about bacterial contamination. 51% see a (high) need for water treatment. Of all the users (see Table 1, lower part "SODIS users"), 83% think it is not time-consuming to do SODIS, 72% do SODIS on a strongly habitual basis, and 76% think SODIS is worth a lot more than it costs. See Table 1 for the complete frequencies.

Table 1: [Table 1 of Study 1] Percentages of persuasion variables

SODIS non-users and users (*N* = 783)

Variable	Very high / very important / very probable / no costs / not time-consuming	High / important/ probable / cheap / slightly time-consuming	Low / slightly important / slightly probable / expensive / time-consuming	Very low / not important / not probable / very expensive / very time-consuming	Missing
SODIS use	9.3 (regular use)	1.5 (sporadic use)	0 (stopped use)	89.2 (no use)	0
Intention to use SODIS	59.6	33.1	6.0	0.8	0.5

Intention to talk about SODIS	64.7	31.1	3.3	0.5	0.5
Conviction health	61.7	35.2	2.6	0.2	0.2
Conviction money	75.5	15.3	5.4	1.0	2.8
Involvement (need for water treatment)	28.4	22.6	17.2	31.2	0.7
Social influence	6.4	18.5	27.2	19.2	28.7

	Very good / positively	Good / positively	Slightly good / positively	Neither good nor bad	Slightly bad / negatively	Bad / negative	Very bad / negative	Missing
Attitude	54.8	40.1	4.0	0.5	0.1	0.1	0	0.5
Affect	45.7	45.7	6.4	0.9	0.3	0.1	0	0.9

	High	Middle	Low	Missing
Knowledge about bacteria	2.6	40.7	56.7	0

SODIS users ($N = 95$)

	Very high / very important / very probable / no costs / not time-consuming	High / important/ probable / cheap / slightly time-consuming	Low / slightly important / slightly probable / expensive / time-consuming	Very low / not important / not probable / very expensive / very time-consuming	Missing
Conviction time	83.2	8.4	0	0	8.4
Habit strength	71.6	14.7	4.2	1.1	8.4
Perceived benefit	75.8	10.5	1.1	0	12.6

Hypothesis (I), which states that the intention to use SODIS is predicted by the persuasion variables, can partly be confirmed (see Table 2 and 3). Since users could answer some questions that non-users could not (e.g. as regards habits), two calculations were performed. A linear regression on the intention to use SODIS was calculated separately for users (see Table 2) and non-users (see Table 3) with the identified persuasion variables. For users, the intention to use SODIS is predicted (adjusted $R^2 = .40$) by the habit strength ($\beta = .30$, $p = .002$), by conviction as regards health ($\beta = .35$, $p = .006$), by social influence ($\beta = .30$, $p = .008$), and marginally by affect ($\beta = -.19$, $p = .085$), the attitude towards SODIS ($\beta = .23$, $p = .055$), and self-persuasion ($\beta = .21$, $p = .062$).

Table 2: [Table 2 of Study 1] Linear regression on intention for SODIS users

	Non-standardized coefficients		Standardized coefficients	t	Sig.
Variable	B	Std. Error	Beta		
(Constant)	.561	.107		5.23	.000
Knowledge about bacteria	-.021	.029	-.073	-0.721	.474
Affect	-.122	.070	-.192	-1.75	.085
Attitude	.171	.087	.232	1.96	.055
Perceived benefit	.036	.105	.041	0.341	.734
Involvement	-.062	.047	-.137	-1.32	.192
Habit	.148	.047	.297	3.16	.002
Conviction money	.037	.078	.047	0.479	.633
Conviction time	.087	.104	.083	0.842	.403
Conviction health	.260	.092	.352	2.83	.006
Ability	-.074	.052	-.136	-1.43	.158
Self-persuasion	.065	.034	.208	1.90	.062
Social influence	.069	.025	.297	2.73	.008

Dependent variable: Intention to use SODIS

Adjusted R^2 = 0.40

The second part of Hypothesis (I) was also partly confirmed (see Table 3): a regression analysis was used to test whether the intention to use SODIS is predicted for non-users by the identified persuasion variables. For non-users, the intention to use SODIS is predicted by their attitude towards SODIS ($\beta = .39$, $p = .000$), by their involvement ($\beta = .10$, $p = .013$), their conviction health ($\beta = .12$, $p = .002$), their process ability ($\beta = -.10$, $p = .006$), and marginally by their knowledge about bacteria ($\beta = .06$, $p = .093$), (adjusted $R^2 = .28$).

Table 3: [Table 3 of Study 1] Linear regression on intention for non-users

	Non-standardized coefficients		Standardized coefficients	t	Sig.
Variable	B	Std. Error	Beta		
(Constant)	.337	.035		9.57	.000
Knowledge about bacteria	.035	.021	.063	1.68	.093
Affect	.045	.042	.049	1.08	.281
Attitude	.390	.047	.387	8.24	.000
Involvement	.055	.022	.097	2.48	.013
Conviction money	.000	.003	.002	0.060	.952
Conviction health	.097	.032	.124	3.04	.002
Ability	-.077	.028	-.101	-2.73	.006
Self-persuasion	.030	.025	.048	1.20	.232
Social influence	.009	.011	.033	0.878	.380

Dependent variable: Intention to use SODIS

Adjusted $R^2 = 0.28$

Overall, this means the intention to use SODIS is higher for users when people are convinced that drinking untreated water is unhealthy, when they think that others think positively about them when they use SODIS (social influence), when the habit to use SODIS is stronger. Tendencially, the intention of users is higher, when they have an overall positive affect and

attitude towards SODIS, and when they talk more about SODIS (self-persuasion). The intention of non-users is higher, when they had more time to think about information about SODIS (ability), ,and when they see a need for water treatment (involvement), when they have an overall positive attitude towards SODIS, and when they are convinced that drinking untreated water is unhealthy. Additionally, there is a tendency that the intention of non-users is higher when they have good knowledge about bacterial contamination of water.

Hypothesis (II) was not supported (see Table 4). It was hypothesized that the higher (or more positive) the identified persuasion variables, the more SODIS-treated water a SODIS user consumes as part of his or her overall drinking water. Not all persuasion variables proved to have an influence on the amount of SODIS water consumed, but ability, habit and (marginally) involvement did. A linear regression on the amount of SODIS water consumed showed that the higher the involvement ($\beta = .23$, $p = .068$) and the habit to use SODIS ($\beta = .24$, $p = .042$), and the lower the ability ($\beta = -.24$, $p = .039$), the more SODIS-treated water a SODIS user drinks. The overall explained variance by these variables is low (adjusted $R^2 = .11$).

Table 4: [Table 4 of Study 1] Linear regression on amount of SODIS for users

	Non-standardized coefficients		Standardized coefficients	t	Sig.
Variable	B	Std. Error	Beta		
(Constant)	17.19	29.55		0.582	.563
Knowledge about bacteria	6.58	6.99	.115	0.942	.350
Affect	28.59	17.37	.219	1.65	.105
Attitude	-36.59	22.99	-.233	-1.59	.117
Perceived benefit	7.89	26.96	.043	0.292	.771
Involvement	21.23	11.43	.232	1.86	.068
Habit	24.06	11.58	.241	2.08	.042
Conviction money	-20.27	19.22	-.128	-1.05	.296
Conviction time	39.93	26.99	.177	1.48	.144
Conviction health	2.43	22.72	.016	0.107	.915
Ability	-32.96	15.63	-.238	-2.11	.039
Self-persuasion	-3.30	8.49	-.052	-0.388	.699
Social influence	-0.174	6.18	-.004	-0.028	.978

Dependent variable: Amount of SODIS consumed

Adjusted $R^2 = 0.11$

Hypothesis (III) was partly supported. The higher (or more positive) the identified persuasion variables, the more likely it is for someone to be a SODIS user. Some of the identified persuasion variables do indeed increase the likelihood of a person being a SODIS user (see Table 5). A binary logistic regression (ENTER method) for the dependent variable of using SODIS shows that whether a person uses SODIS is significantly influenced by involvement (B = 2.21, p = .000), ability (B = 5.08, p = .000) and marginally by social influence (B = 0.76, p = .076), (Nagelkerke's R^2 = .70). This means the more someone is involved, the more ability to process someone has and the more social influences someone experiences, the more likely that person is to use SODIS.

Table 5: [Table 5 of Study 1] Logistic regression: users vs. non-users

Variable	B	S.E.	Wald	df	Sig.	Exp(B)
Knowledge	0.106	0.512	0.043	1	.835	1.11
Affect	0.145	1.41	0.010	1	.919	1.15
Attitude	16.98	8171	0.000	1	.998	23597602
Involvement	2.21	0.508	18.93	1	.000	9.10
Conviction money	-1.47	0.931	2.49	1	.114	0.230
Conviction health	18.78	8841	0.000	1	.998	143547087
Ability	5.08	0.619	67.46	1	.000	161
Self-persuasion	-0.599	0.441	1.84	1	.175	0.549
Social influence	0.763	0.430	3.15	1	.076	2.14
Constant	-42.46	12039	0.000	1	.997	0.000

Dependent variable: Group membership: users vs. non-users

Nagelkerke's R^2 = .70

Overall, different variables were found to influence intention (of non-user and users), uptake and amount of SODIS consumed. The variables that influence the uptake of SODIS are involvement, ability to process and social influence. The amount of SODIS water consumed is influenced by involvement, habit and ability. For users, the intention to use SODIS is influenced by conviction health, habit, social influence, self-persuasion, affect, and attitude. For non-users, the intention is influenced by attitude, ability, involvement, conviction health and

knowledge. These variables will consequently be used to design interventions for a SODIS dissemination strategy.

Discussion

Interpretation of Results

The intention to use SODIS is influenced by different persuasion variables for those who use SODIS (users) and those who do not (non-users). The users' intention is predicted by their habit strength, their conviction about health, their social influence, and – as a tendency – by their affect and attitude about SODIS as well as by self-persuasion. This means that if it is easier for people to remember to use SODIS, if they are convinced that untreated water is unhealthy, if people think that others think positively about them when they use SODIS, then their intention to use SODIS will increase. There is also a tendency that if people feel and think positively about SODIS and if they talk more often about it, their intention to use SODIS can grow stronger.

For non-users, the intention to use SODIS is predicted by attitude, involvement, conviction health and ability and – as a statistical tendency – by knowledge. This means if someone who does not use SODIS thinks positively about it, thinks that there is a need for water treatment and that untreated water is unhealthy, if he or she has time to think about the information they receive, then that person has a higher intention of using SODIS. There is also a tendency for this to happen through knowing more about bacterial contamination.

Whereas both users and non-users need to be convinced that raw water is unhealthy and need a positive attitude to generate a high intention of using SODIS, there are greater differences between these two groups. More important factors for users are what others think about them, developing a habit to use SODIS, their positive feelings about SODIS and how

much they talk about it. Users seem partly to convince themselves how good SODIS is by telling others that it is good and by experiencing its benefits through habitual use. For non-users, it is more important to know about bacterial contamination of their water, to have enough time to think about SODIS and to consider it to be necessary to treat their water. These factors seem to be more rational influences on their intention, whereas the users seem to be considering several, also more affective, issues in making up their mind about SODIS. It is clearly a different step, involving different premises, to develop a strong intention to use SODIS for those who have not used it before than for those who are already using it.

For a SODIS user to consume SODIS as a large part of his or her drinking water (amount of water consumed), it is important to have enough time to process the information about SODIS (ability) and to develop the habit of using it. The fact that the user feels a great need to treat his or her drinking water (involvement) also reveals a trend to influence the amount of SODIS consumed. However, considering what a small variance in the amount of SODIS water consumed can be explained (11%) by all the persuasion variables used, it seems that persuasion is not the most important factor in the use of SODIS. Persuasion seems to have a stronger influence on the uptake (whether to use SODIS or not). This becomes visible in the degree of influence that the persuasion variables have on the intention and uptake (being a user or non-user). However, the extent of use of SODIS (amount of SODIS water consumed) does not seem to depend on the quality of the persuasion process.

Persuasion variables play a strong role in whether someone uses SODIS or not. Involvement in water treatment increases the likelihood of someone being a SODIS user by 810 percent, ability by 1600 percent and social influence by 114 percent (these values can be inferred from expected β). This means for people to have enough time to think about the message they received about SODIS is the most important factor for them to decide to use SODIS. The

assessment as to whether water treatment is necessary is the second most important premise that raises the likelihood of uptake. When other people seem to think positively about SODIS, the chance of becoming a SODIS user increases considerably for the person who reflects on what the others are thinking.

Thus, the most important persuasion variables for the uptake and for the increase in its use seem to be: involvement, ability, attitude, conviction of health, habit, social influence, self-persuasion, affect and knowledge. Possible interventions for a dissemination strategy for SODIS should consequently tackle these topics.

Strength and Weaknesses of the Study

Some of the primarily identified persuasion variables did not show a significant influence on the use or intention to use SODIS. The convictions about money (how expensive they find SODIS) and time (how time-consuming they find it) as well as the perceived benefit of using SODIS had no significant influence on the intention to use SODIS, the uptake, or the amount of SODIS consumed. This could be because people need experience in using SODIS in order to assess these issues. The period of a few minutes between hearing about SODIS and having to give an opinion about how expensive it would be, without having any experience of it, may simply be too short. And a large part of the interviewees, namely those who heard about SODIS at the interview, had only a few minutes to make this assessment. The three weeks or less that the people who heard about SODIS before the interview had may also not have been enough to build a realistic opinion about how time-consuming or beneficial SODIS actually is.

Looking at the percentages of people who responded in a particular way to the various topics that we asked them about, it also becomes clear that the variables that showed no impact in the calculations exhibit very little variance. Over 70%, and in the case of the conviction

about time-consumption, even over 80% of the people gave a very positive response. They agreed that SODIS is very beneficial, does not cost anything and does not take time. Apart from expressing these opinions because they had little experience with the negative, time-consuming or expensive sides of SODIS, this can also be due to a noted tendency of the people to respond in a socially acceptable way. In Zimbabwe, and especially in the poorer areas, it is frowned upon to give negative answers to a topic. This strong desire to respond positively can impair interviews considerably. Future interviews in Zimbabwe should consider this fact and try to work out ways of asking people that allow them to answer negatively in a socially acceptable way. One example of this would be to make negative statements and ask "How far do you agree to that?".

Although not all the proposed variables showed a significant influence, the overall explained variance of the intention and especially the uptake (user or non-user) was considerable. However, the explained variance of the amount of SODIS consumed was low. This result points to different effects of persuasion on the decisions about the uptake of a chosen behaviour and its execution. Habit strength seems to be a factor that sustains behaviour, whereas the other persuasion variables are more important for developing the intention to use SODIS and for the decision to use SODIS or not (uptake). Further research is needed to make sound statements about the field of impact of persuasion.

The influence of the persuasion variables found in this study agrees with past findings. The intention to use SODIS and uptake of it were found to be linked to a positive attitude and affect towards SODIS (Altherr, Mosler, Tobias, & Butera, 2008). It had also been found earlier that the use of SODIS by neighbours (social influence) and knowledge about SODIS were correlated with the intention to use SODIS (Altherr, et al., 2008). That these and other variables could be confirmed in this field study shows their consistent impact and supports the validity of employing them in strategies for disseminating SODIS.

Implications for Practice

Since involvement and ability have been shown to have an impact in more ways than one, they are the most important variables to use for the dissemination of SODIS. Involvement can be increased when people think that there is a great need to treat their water. If someone knows about the contamination of his or her drinking water, that this contamination can cause sicknesses and how this contamination happens and can be avoided, he or she should find it more necessary to treat the water. Thus, knowing more about ways of contamination and its relation to sickness should raise the involvement. Knowledge about water contamination can be easily disseminated and people can be persuaded about the necessity of treating their water by using flyers and/or promoters to spread the corresponding information. People could be additionally persuaded of the necessity of treating water by pointing out sicknesses that they or their family could suffer and that these sicknesses are avoidable.

The ability to process information about SODIS increases with time. Another way to enhance this ability would be to explain the topic and its background in more detail. This and repetition of the message at regular intervals should increase the ability to understand SODIS and consequently the intention to use it.

Social influence is another important factor for people to opt for SODIS. Apart from improving the overall opinion and attitude of people in an area where SODIS is to be implemented, it would be important to get people to talk about it. Presenting the advantages of SODIS (e.g. with flyers, posters or personally) and asking people to talk about it with others or starting up a snowball system (e.g. “please tell three other people about SODIS and its benefits and ask each of them to tell three others”) can help to spread this social influence.

Getting people to talk about SODIS initiates another important factor, namely self-persuasion. If this is to have a positive impact, however, the overall attitude and convictions about SODIS will need to be equally positive.

Convictions, overall attitude and affects can be shaped by persuasion that bolsters the benefits of SODIS with good arguments. It is important for the arguments to be logical, understandable and presented by someone with whom the recipient of the arguments can identify and who he or she perceives as credible.

Since habit strength persuades users to keep on using SODIS and affects the amount of SODIS water consumed, the habit should also be supported. Memory aids help people not to forget to use SODIS. Prompts are an example of memory aids which are easily set up: a poster, sticker, picture or table card points out: “Have you put your bottles in the sun today?” or something similar. Other psychological strategies to help people develop a habit can include commitment, request or feedback.

However, all these persuasive strategies should not let us ignore any outer circumstances that might prevent people from carrying out the required behavior. For SODIS, this would mean: are bottles available and affordable to the target group? Do they have sunny places where they can put the bottles and is the water clear enough for SODIS? Helping people to implement something like SODIS requires more than psychological support. The external possibilities must also be in place. For a campaign, this means that these circumstances should be examined and, if necessary, help should be provided to establish a bottle diffusion scheme or showing people how to filter dirty water and to identify other obstacles that could prevent them from using SODIS.

Conclusion and Outlook

Involvement, ability, attitude, conviction as regards health, social influence, self-persuasion, affect and knowledge all play an important role in the decision to use SODIS. To work with these elements will influence people's intention to use SODIS and their choice to become SODIS users. These points should consequently be considered for any SODIS campaign run in the future. Examples of how these factors can be involved in future campaigns were given in the previous section.

However, these or similar factors can be of help in campaigns in many other fields, such as those aiming to change behaviour concerning health, hygiene, sustainability issues or innovative technologies. Any planned activity or public works could include these factors in order to increase their impact and effectiveness.

It became clear that persuasion is especially effective for the first phase of campaigns: the try-out or uptake period. Once people show the intended behaviour, other psychological variables should be employed to support this behaviour over the long term.

The persuasion variables that have proved to be effective will now be used for a campaign targeting the same areas in which the data has been collected. This should help to increase the number of SODIS users considerably. More interviews and their analysis will show whether these variables and the strategies that have been designed with their help actually have the anticipated effects. This will contribute to further improve future SODIS campaigns and will keep on generating ideas and outcomes for SODIS and other fields of public work.

Since SODIS is a very beneficial method, not only for preventing illnesses and alleviating life conditions, but also by its contribution to sustainable techniques and procedures in any field of practice, it is worth spending time and effort into finding the most effective ways of spreading it fast and far.

Study 2:

Effectiveness and Effects of Promotion Strategies for Behaviour Change: Solar Water Disinfection in Zimbabwe

Abstract

Solar water disinfection (SODIS) is a sustainable method of water treatment. With the help of the sun and (used) plastic bottles, water is treated and illnesses prevented. Despite the simplicity and many advantages of SODIS, past dissemination campaigns could have been more successful. Since this is true for many environmental or developmental campaigns, these processes need to be better understood. By answering whether the used interventions change behaviour and how they do this, more effective and efficient campaigning shall be made possible. The following factors have been shown to change behaviour and are analyzed in this study: intention, subjective norm, behavioural control, convictions, habit, frequency of talking, knowledge and tension. It could be shown that the used interventions had different effects on these behaviour change factors. Mostly, the expected effects of the interventions can be proven. Promoters influence more factors more successfully than expected, while the effect of the pass-on-task was not as good as expected. Prompts and public commitment work very similarly and create more tension than the "knowledge and tension strategy", which will be discussed. More effective intervention strategies could be identified and discussed with the help of these results.

Key words: Intervention, SODIS, solar water disinfection, behaviour change, campaign, factors, Theory of Planned Behaviour

Introduction[1]

Although clean water is a human right, 1.1 billion people still do not have access to safe drinking water (WHO, 2006a). About 1.8 million people die from diarrhoeal illnesses every year (WHO, 2007). These illnesses are mainly due to a lack of safe drinking water, sanitation and hygiene. This means many deaths could be avoided and living conditions improved by enabling access to safe drinking water. Boiling water is one common method of treating unsafe water to avoid diseases. However, it uses a lot of natural and human resources, requiring fuel (wood or gas) as well as time and effort. Solar water disinfection (SODIS) is a way of treating water with the help of the sun and plastic bottles that is more sustainable. It uses a waste product (used plastic bottles) and the sun to treat drinking water instead of using wood or gas for boiling or chemicals for disinfecting.

SODIS is a pro-poor household-based water treatment method. PET bottles filled with water are exposed to sunlight for six hours (or two consecutive days if it is more than 50% cloudy). This procedure inactivates pathogens that are responsible for waterborne diseases like diarrhoea, dysentery or cholera (Berney, Weilenmann, Simonetti, & Egli, 2006; Joyce, McGuigan, Elmore-Meegan, & Conroy, 1996; Wegelin et al., 1994). The sunlight destroys these pathogenic micro-organisms through two mechanisms, namely UV-A radiation (wavelength 320-400nm) and increased water temperature (Meierhofer & Wegelin, 2002). The consumption of SODIS treated water significantly reduces the diarrhoea rate of people previously consuming untreated water (Conroy, Meegan, Joyce, McGuigan, & Barnes, 2001; Rose et al., 2006). However, Graf, Meierhofer, Wegelin and Mosler (2008) could show that the protective effect of safe water on children under 5 years only occurred, when a high percentage of safe water was consumed.

[1] This study was submitted for publication: Kraemer, S. M., & Mosler, H.-J. (in review). Effectiveness and effects of promotion strategies for behaviour change. *Applied Psychology: An international review*.

The low cost needed for the application of SODIS is particularly important for those who do not have access to other methods for water treatment due to high cost (wood or fossil fuels) or non-availability of resources needed for the application. By contributing to overall health, SODIS also creates economic benefits by making more working days available and saving money for medication.

SODIS is not only socially sustainable, giving people the chance to improve their living conditions independently of external help, but also environmentally sustainable, as the winning of the Energy Globe Award shows (Energy Globe, 2004). PET bottles, which are otherwise only a source of pollution, are re-used, and firewood or gas, which would otherwise be used for boiling water, is saved. Deforestation is slowed down and air pollution avoided; instead, a sustainable energy source, namely the sun, is used.

In spite of all these obvious advantages, SODIS is usually not used as widespread and immediately as one would expect, considering how beneficial it is (Altherr, Mosler, Tobias, & Butera, 2008; Moser, Heri, & Mosler, 2005; Tamas, Tobias, & Mosler, 2009). The reasons for this are still not fully understood. In order to run more successful dissemination campaigns in the future, it is important to know which factors contribute to successful interventions which enhance the behaviour change of using SODIS instead of drinking raw water. There is consequently a need to analyse how promotion strategies change behaviour. To do this, it needs to be examined, how interventions affect behaviour-changing factors.

Promotion Strategies

The following promotion strategies which were used in a SODIS promotion intervention in Zimbabwe are of interest in this paper: promoters, a pass-on-task, prompts, public commitment and disseminating knowledge with inducing tension ("knowledge & tension

strategy"). Using *promoters* is a common practice in campaign-work (e.g. Uitenbroek, Wal, & Weert-Waltman, 2000), where persons are selected, paid and trained for going from household to household to induce behavioral change. The *pass-on-task* is a strategy where persons are selected and trained to perform a task dedicated to their social network (Mosler & Gutscher, 2004). This was a way of trying to activate self-dissemination of and communication about SODIS. *Prompts* and *public commitment* are interventions which are widely and successfully used in environmental psychology (Abrahamse, Steg, Vlek, & Rothengatter, 2005; De Young, 1993; Mosler & Tobias, 2007; Wang & Katzev, 1990). The "knowledge & tension strategy" is inspired by the work of Kantola, Syme and Campbell (1984), who induced a dissonance-like tension by confronting people with their discrepancy between their attitudes and their behavior. The aim is to change (environmental) behaviour by inducing *tension* by presenting the reasons why something should be done (in this case these reasons are *knowledge* about water contamination, sicknesses and water treatment) and then making a person aware of the difference between what should be done and what is done. A detailed description of each promotion strategy applied in this investigation and when and where they were used, is provided in the "Methods" section.

Behaviour-changing Factors

To understand the functioning of the mentioned promotion strategies it is important to analyze which psychological factors are differentially affected by these strategies. To support which behavioural factors to look at, the Theory of Planned Behaviour (TPB) (Ajzen, 1991) was chosen as the basis. That model covers the factors *intention*, *subjective norm*, *behavioural control* and attitude, as proven by many studies (e.g. Ajzen, 1991; Bamberg & Möser, 2007; Beale & Manstead, 1991; Reinecke, Schmidt, & Ajzen, 1996). Since *convictions* about the attributes of SODIS seemed to be more meaningful than the overall attitude in this

context, the conviction about how *time*-consuming SODIS is, the conviction about how much *money* SODIS costs and the conviction about how SODIS *taste*s were used instead of attitude. The promoter strategy is supposed to influence convictions and behavioral control because promoters should try to convince that SODIS is not time-consuming, doesn't cost much money, improves the taste and is easy to do. Public commitment is also expected to have an impact on subjective norm as people see who is actually performing the behavior.

The factors from the Theory of Planned Behaviour were supplemented by *habit*, because this factor was shown to be a very strong or the strongest predictor of behaviour in several studies, as the meta-analysis of Conner and Armitage (1998) about the Theory of Planned Behaviour and additional factors shows. It is expected that habits will be influenced by prompts and public commitment because they serve as reminders for the behavior.

Self-persuasion occurs when someone talks about a topic; the point of view which they communicate has a persuasive influence on them (Frey & Gaska, 1993). Thus, by talking about a topic, self-persuasion has a powerful and long-lasting effect on attitudes and behaviour (Aronson, 1999). *"Frequency of talking"* will therefore be included in this analysis as another factor. The pass-on-task is assumed to influence the talking about SODIS because for passing on, people have to talk to each other. Also public commitment will affect talking, because people see that the behavior is a topic in the community.

In a meta-analysis, Zelezny (1999) found strong correlations between *knowledge* and behaviour. Similar to a study about manatee conservation in Florida, where knowledge was found to be correlated to manatee conservation support additionally to the proposed factors from TPB (Aipanjiguly, Jacobson, & Flamm, 2003), knowledge will be used as a supplementary factor to the model. It is taken for granted that the dissemination of knowledge will increase the knowledge of the targeted people

"*Tension about forgetting to use SODIS"* is the last factor to be added to TPB; the motivation springing from a perceived inconsistency was shown to influence behaviour (Festinger, 1962; Harmon-Jones & Mills, 1999; Kantola, Syme, & Campbell, 1984). The strategy 'evoking tension' should increase this factor.

All these factors are assumed to cause behaviour change: intention, subjective norm, behavioural control, (the SODIS-relevant) convictions, habit, frequency of talking, knowledge and tension.

Research Questions

The overall question that this paper aims to answer is: Do the interventions which were used change behaviour and how? In detail, this question consists of two parts:

(I) Does the behaviour change over time due to the interventions?

(II) How do the interventions change factors that underlie behaviour change?

Methods

Research Area

Field research was carried out in informal settlements in high-density areas around Harare. Harare is the capital of Zimbabwe, which currently has the highest inflation rate in the world and is thus economically very unstable. The municipal infrastructure, including the water supply and sanitation is relatively good, but the high-density areas and so-called informal settlements that grew after a governmental relocation of city residents in 2005, such as Epworth and Hopley Farm, widely lack access to sanitation and safe drinking water (Amnesty International, 2006). Only 47% of the 13 million inhabitants of Zimbabwe in the rural areas have access to improved sanitation, 72% have access to improved drinking water sources and the

mortality rate of children below five is 10%. Of these, 12% die from diarrhoeal diseases (WHO, 2006a). These numbers are believed to be higher in the high-density areas and to increase rapidly with the deteriorating situation in Zimbabwe. As most people get their water from unsafe water sources such as (unprotected) wells, as secondary contamination is high and most people do not treat their water, there is great potential for a water treatment technique like SODIS in these areas (Murinda & Kraemer, 2008).

Procedure

Data was obtained by conducting structured interviews in the households of the interviewees. People took part voluntarily in this study and without receiving anything for it. They were chosen randomly, by means of Random-Route-Sampling (Hoffmeyer-Zlotnik, 2003). That means the interviewers (who were local citizens from around Harare and chosen on behalf of their qualifications and work experience) went to every third household on their way through their assigned area. That way, 10 interviewers completed 5 to 8 interviews a day, each one taking about 45 minutes. Interviews were held in Shona, the main native language of Zimbabwe. Rejection rate of the households that were asked to participate was 5%; 926 people were asked to participate, 48 people refused, which leaves a final figure of initially 878 subjects for the survey. The person in the household responsible for the drinking water of the members of the household was interviewed.

The baseline interviews took place in May 2007, two to three weeks after an information event about SODIS in the respective areas. People were informed about these information events by local leaders and through posters. Since some people had heard about SODIS like this, the questionnaire started with questions about SODIS use which led to a section with questions about details of its use for those who used SODIS or to general questions about

drinking water, water sources, knowledge and convictions related to water treatment for those who did not use SODIS. If people had a preferred method of water treatment, they answered the next section about this method, and were then asked general questions about health and washing hands. The next step was for the interviewers to provide standardized information about SODIS to the interviewees. That made sure that everyone could answer the next part, namely general questions about SODIS. Sections about communication, motivation, habits and network formed the last part of the questionnaire.

Five months after the information events, in October 2007, a first phase of interventions were carried out, which were based on findings from the baseline questionnaire (see figure 1). The two broader project areas could be split up into four intervention areas and one control group. Two of these areas (area 1 and 2) received information and persuasive communication delivered by promoters, another two areas (areas 3 and 4) received the same information and persuasive communication delivered by means of a pass-on-task. A pass-on-task is a snowball system which is meant to enhance interpersonal communication about SODIS. In area 3 and 4, very few promoters were active, visiting every fifth household. After the information given, the members of the household are asked to pass the information about SODIS on to someone else. Then they received a token with which they can receive a transparent plastic bottle for half price at a bottle centre. These bottle centres are shops where plastic bottles are sold, which are run by a trained promoter of SODIS. Whenever someone buys a bottle at the bottle centre, that person is informed about SODIS, given (another) token and asked to pass this token on to someone else. The last area (area 5) serves as a control area. Please see figure 1 for an overview about the timeframe.

Figure 11: [Figure 1 of Study 2] Timeframe of interventions and interviews

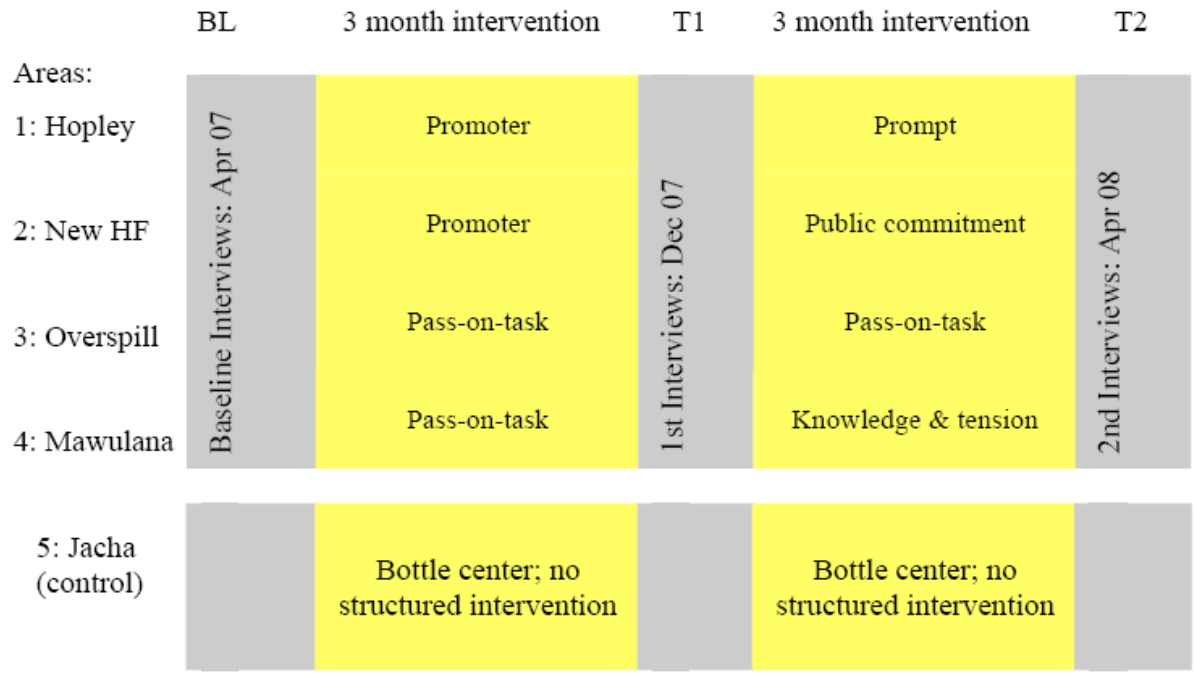


Figure 1 shows that interviews were alternated with intervention phases. One month after the first intervention, the same kinds of interviews as in the baseline were carried out. Three months after the first phase of interventions, a second phase of interventions was implemented and after that, again interviews. During the second phase of interventions, memory aids were distributed in area 1 and 2. Area 1 received stickers for inside the home which served as prompts. These stickers showed a person putting up bottles on the roof and above it said: "Have you put your bottles on the roof yet?" in Shona, the local language. In area 2, stickers were used for public commitment: they were put on a prominent spot outside the home and said: "Here we use SODIS because it makes us healthy". In area 3, the pass-on-task was used a second time. Area 4 received an intervention that was meant to create tension about not using SODIS: promoters gave background knowledge on how water can be contaminated, how that can create illnesses and how these can be prevented. At the end, the promoters asked: "Are you doing SODIS?". Area 5 remained the control area.

Sample

The participants in this field research were $N = 878$ inhabitants of high-density areas, $N = 364$ from Hopley Camp Farm, southwest of Harare, and $N = 514$ from Epworth, southeast of Harare. The interviewees were $N = 802$ (91%) women and $N = 76$ men. The mean age was $M = 34$, the mean number of years of education were $M = 8$ years, the mean income was $M = 400.000$ Zim$ (about 15 US$ at that time) per month per household ($M = 4.5$ persons per household). This means that on average, people in the research areas live far below the poverty line of 1US$ per day. Most people in the project areas are unemployed (24%), vendors (20%), informal traders (11%) or housewives (17%). On average, there is one child ($M = 0.9$) below five years of age in each household.

The drop-out-rate for the interviews at T1 (after the first intervention) was n = 83, leaving N = 764. After the interviews at T2 (after the second set of interventions) was n = 6, leaving N = 758. Some of the interviewees did not participate in T1, but in T2 and are therefore excluded in the calculations which require subjects to take part in all points of time. For these calculations, data from N = 614 subjects is utilized.

Questionnaire

Behaviour: Two questions are asked to assess SODIS behaviour - one for determining the number of SODIS users and one for the amount of SODIS water used. “Are you doing SODIS?” identifies SODIS users. This question has four possible answers: am doing SODIS regularly / have tried SODIS and am doing it sometimes / have tried SODIS but stopped / am not doing SODIS. Thus, SODIS users are those who are doing SODIS regularly or sometimes and SODIS non-users those who do not do SODIS. The amount of SODIS water one household drinks per day is assessed with “How many litres of which kind of water does your family drink

per day?" with an open answer to each applicable category of drinking water. All the answers of one household to each category of water were taken together to form the overall amount of consumed water. With this, the percentage of SODIS water in the overall drinking water was calculated. Both types of SODIS behaviour questions were compared with observations to SODIS behaviour and found to be similar.

Intention: The intention to do SODIS was surveyed using the question "Will you be doing SODIS regularly in the next two weeks. Five answers were possible: very probable / probable / quite probable / slightly probable / not probable.

Subjective norm: The subjective norm was surveyed with "How do other people think about you when you do SODIS?" Answers were: very positively / positively / quite positively / slightly positively / neither positively nor negatively / slightly negatively / quite negatively / negatively / very negatively.

Behavioural control: How difficult using SODIS is perceived to be was examined with the question: "How difficult is it to prepare SODIS?". Possible answers were: very much / much / quite much / a little bit / not difficult at all.

Conviction time: how time-consuming SODIS is perceived to be is measured with "How much time does SODIS take and how time-consuming do you find that?". Answers: very time-consuming / time-consuming / quite time-consuming / slightly time-consuming / not time-consuming.

Conviction money: Conviction as regards money is asked with "How much money does it cost to treat your water with SODIS and how expensive do you find that?". Answers: very expensive / expensive / quite expensive / slightly expensive / not expensive.

Conviction taste: How the taste of SODIS was perceived was measured with "How does SODIS water taste?". Answers: very good / good / quite good / slightly good / neither good nor bad / slightly bad / quite bad / bad / very bad.

Habit: Habit strength is measured with "Is doing SODIS a habit for you?" Answers were given in five steps: very much / much / quite much / a little bit / not at all.

Frequency of talking: How often someone talks about SODIS was surveyed with: "How often do you talk about SODIS or water treatment?". Answer possibilities have the range of: (almost) always / often / sometimes / rarely / never.

Knowledge: Knowledge about the safety of raw water was surveyed with the question: "Do you think that drinking raw water makes you healthier or less healthy?" Answer categories: much healthier / healthier / quite healthier / slightly healthier / neither healthier nor unhealthier / slightly unhealthier / quite unhealthier / unhealthier / much unhealthier.

Tension about forgetting to prepare SODIS: How tense someone feels about forgetting to use SODIS is measured with the question: "How much does it bother you if forget to do SODIS?". Answers were given in five steps: very much / much / quite much / a little bit / it does not bother me.

All of the answers have been standardized to range from 0 to 1 or from -1 to +1 (in the case of bipolar variables). The answer that is most in favour of the behaviour is 1, the answer that is most against the behaviour is 0 or -1 (in the case of bipolar variables). The bipolar variables have seven-point-scale answer categories, the unipolar variables five-point-scale.

Results

Data from a total of $N = 614$ subjects, who were answering the interviews at all three points of time, was utilized for analysis. For all GLM analysis, the Greenhouse-Geisser F-

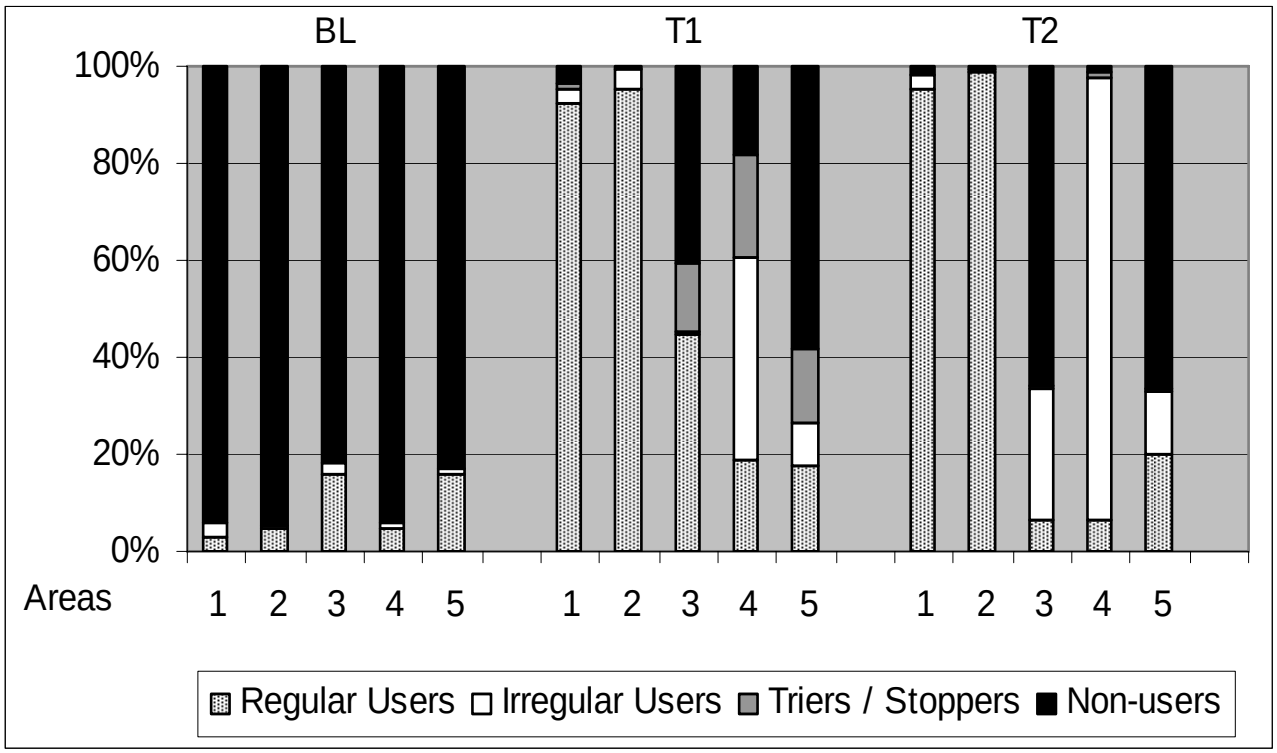
value is discussed. Pair-wise analyses mentioned in the following GLM calculations is always the post-hoc Bonferroni method based on estimated marginal means.

Behaviour Change through Interventions

To answer research question (I) “Does the behaviour change over time due to the interventions?”, first of all, the change in the numbers of users will be looked at graphically. The kinds of users were split up into subjects who stated to use SODIS regularly (“regular users”), those who stated to use it sometimes (“irregular users”), people who tried out SODIS, but had stopped using it in the meantime (“Triers / Stoppers”) and those who do not use SODIS (“non-users”).

Figure 2 shows clearly, that from the baseline interviews (BL) to after the first intervention (T1), the number of users increases in all the areas. Less so in the control area and in the two areas where the pass-on-task is used. The most successful areas are 1 and 2, where the promoters have been disseminating SODIS. After the second set of interventions, the difference between the areas (1, 2 and 4), where promoters have been used versus the pass-on-area (3) is even more pronounced, whereas the pass-on-area seems to be more similar to the control area (5).

Figure 12: [Figure 2 of Study 2] Percentages of SODIS users (irregular, regular), those who tried but stopped and non-users, compared by intervention area and separated for three points of measurement.



Baseline interviews (after information event for all areas): Chi-square tests show that the five areas are different to each other in percentages of users at the time of the baseline ($p < .001$, $\chi^2 = 36.552$, $df = 8$). The percentage of regular users are the same for area 1, 2 and 4 ($p > .10$, $\chi^2 < 6.635$, $df = 1$) and for 3 and 5 ($p > .10$, $\chi^2 < 6.635$, $df = 1$), but differ between these two groups ($p < .05$, $\chi^2 > 7.879$, $df = 1$). Table 1 shows the details about percentages, N, background information on the calculations, and that the differences between the groups at baseline level are not extreme, especially compared to later developments.

Table 6: [Table 1 of Study 2] Number and percentage of regular users for baseline, T1 and T2, with subscript indicators of difference to each other (Chi-square)[1]

	Baseline		Promotional	T1		Promotional	T2	
Area	%	$n_{reguser}$	strategy	%	$n_{reguser}$	strategy	%	$n_{reguser}$
1	$3\%_a$	5	Promoter	$78\%_a$	122	Prompt	$94\%_a$	147
2	$5\%_a$	8	Promoter	$68\%_a$	121	Public com.	$97\%_a$	174
3	$16\%_b$	25	Pass-on	$35\%_b$	54	Pass-on	$6\%_b$	9
4	$5\%_a$	8	Pass-on	$17\%_c$	28	Knowledge	$6\%_b$	9
5	$16\%_b$	31	Control	$13\%_c$	25	Control	$14\%_c$	28
M/Tot.	9%	77	Mean/Total	42%	350	Mean/Total	43%	376

After the first intervention (1&2: promoters, 3&4: pass-on-task, 5: control): At T1, the groups differ significantly from each other ($p < .001$, $\chi^2 = 461.120$, $df = 16$). As is shown in table 1, area 1 and 2 do not differ significantly from each other in the number of regular users ($p > .10$, $\chi^2 < 6.635$, $df = 1$) and area 4 and 5 do not differ significantly from each other ($p > .10$, $\chi^2 < 6.635$, $df = 1$). These two groups are different from each other and from area 3 ($p < .05$, $\chi^2 > 7.879$, $df = 1$). This is a logical outcome, since area 1 and 2 received the same intervention (promoters) and area 3 and 4 both received a pass-on-task. However, the pass-on-task in area 4 worked less well than in area 3 and similar to the control area.

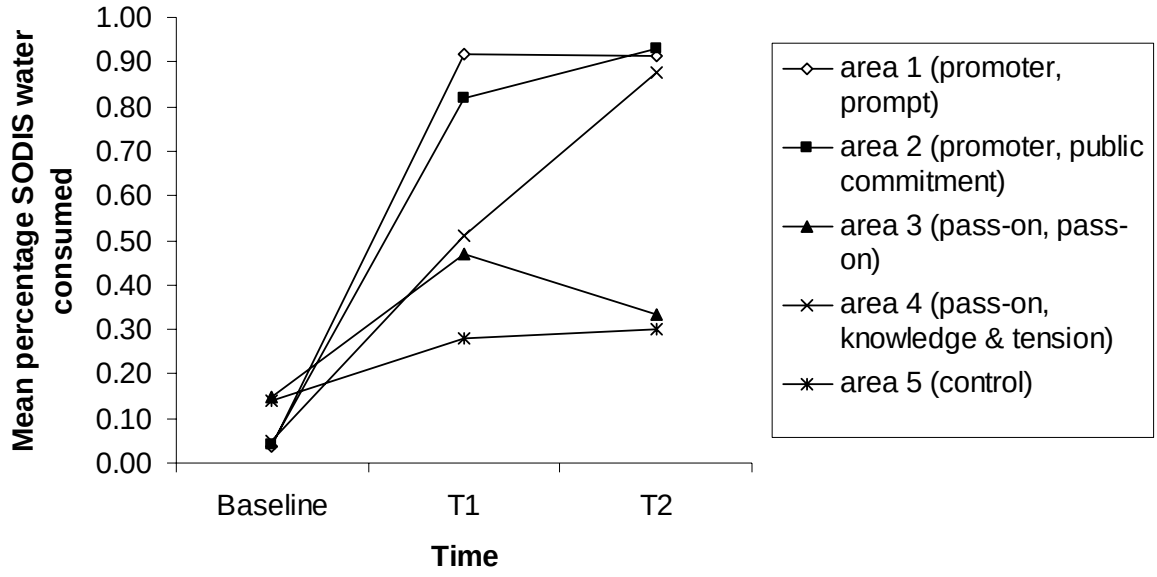
After the second intervention (1: prompts, 2: public commitment, 3: pass-on-task, 4: knowledge & tension strategy, 5: control): At T2, the overall chi-square confirms the difference between the groups ($p < .001$, $\chi^2 = 917.619$, $df = 16$). Pairwise chi-square tests show

[1] Percentages in one column, which do not share the same subscripts, differ from each other at least at $p < .05$ in a pair-wise chi-square test. Since it was necessary to calculate ten chi-square tests to assess the differences between all five groups within one panel in a pair-wise way, the corresponding threshold to define the significance level was adjusted (Sachs, 1978, p. 369).

that area 1 and 2 do not differ significantly from each other in the number of regular users ($p > .10$, $\chi^2 < 6.635$, $df = 1$) and area 3 and 4 do not differ significantly from each other ($p > .10$, $\chi^2 < 6.635$, $df = 1$). Group 1&2 and 3&4 are different from each other and from area 5 ($p < .05$, $\chi^2 > 7.879$, $df = 1$). Apparently, the prompt created a similar number of users as the public commitment. The "knowledge & tension strategy" intervention caused a similar number of regular users as the pass-on-task. Here, the differences only become visible if the number of irregular users (those people who categorized themselves as using SODIS sometimes) is looked at (area 3 with 24%, $n_{irreguser} = 38$, area 4 with 82%, $n_{irreguser} = 133$ irregular users, $p < .001$, $\chi^2 = 123.781$, $df = 1$). The "knowledge and tension strategy" does not create more regular users, but considerably more irregular users than the pass-on-task.

To analyze the impact of the interventions on SODIS behaviour further, a general linear model is calculated with the percentage of SODIS water in the overall drinking water as the dependent variable. The course of percentage SODIS over time can be seen in figure 3.

Figure 13: [Figure 3 of Study 2] GLM with mean percentage of SODIS water consumed per intervention area, over three measurement points



The change of the mean percentages of SODIS water consumed over time is highly significant ($F = 664.20$, $p < .001$, $df = 2$), as well as the difference between the areas ($F = 61.97$, $p < .001$, $df = 4$) and the interaction effect time * area ($F = 52.03$, $p < .001$, $df = 8$). Pair-wise comparisons of promotional strategies confirm the impressions created by Figure 3: area 1 and 2 do not differ significantly and area 3 and 5 do not differ significantly, whereas all other differences between the areas are significant ($p < .001$). Pair-wise analyses between the three time-points show that all points of time are significantly different from each other($p < .001$).

The outcomes of these investigations show that the interventions are changing the behaviour and that they are changing it differently depending on what kind of intervention was applied. The promoter work followed by memory aids (prompt, public commitment) in area 1 and 2 were most successful, followed by the pass-on-task with the "knowledge & tension strategy" (area 4). Area 3 with a pass-on-task twice was the least successful, together with the control area.

Impact on Behaviour-changing Factors

The previous section showed that behaviour was being changed. In this section, it will be analyzed which behaviour-change factors are being influenced by the interventions. To answer research question (II) "How do the interventions change factors that should underlie the observed behaviour change?", one GLM for each supposed behaviour changing factor is calculated. These calculations have been split up between baseline to T1 and T1 to T2. This was done because the interventional groups can be split up differently. Three interventional groups (promoters versus pass-on-task versus control) can be formed for the phase baseline to T1, whereas five interventional groups (prompts versus public commitment versus pass-on-task

versus “knowledge & tension strategy” versus control) can be formed for the phase from T1 to T2.

Table 2 shows the means for each factor at the baseline interviews (M_{BL}) and at the interviews after the first interventions (M_{T1}). This is done for each factor and each area. The areas are split up into the areas 1 and 2, where promoters disseminated SODIS (1, promoter) versus the areas 3 and 4, where the pass-on-task was used (2, pass-on) versus the control area (3, control). Significance levels of change over time, area, the interaction effect of time*area and the differences between the areas will be discussed for each factor after the table.

Table 7: [Table 2 of Study 2] Means for each area (promoter-area versus pass-on-area versus control-area) for each behaviour-influencing factor for baseline (before first intervention) and point of time 1 (after first intervention). [1]

Promotion strategy	M_{BL}	M_{T1}	M_{BL}	M_{T1}	M_{BL}	M_{T1}
	Intention to use SODIS***		Subjective norm***		Behavioural control**	
Promoter	0.80	0.92	0.53	0.86	0.56	0.96
Pass-on	0.84	0.82	0.34	0.72	0.57	0.84
Control	0.87	0.56	0.77	0.70	0.66	0.90
	Conviction time		Conviction costs***		Conviction about taste***	
Promoter	0.05	0.99	0.14	0.98	0.05	0.76
Pass-on	0.05	0.90	0.14	0.81	0.02	0.60
Control	0.08	0.97	0.06	0.88	0.01	0.57
	Habit(*)		Frequency talking***		Knowledge***	
Promoter	0.86	0.91	0.54	0.87	0.89	0.84
Pass-on	0.91	0.70	0.51	0.76	0.67	0.84
Control	0.99	0.75	0.53	0.68	0.89	0.69
	Tension***					
Promoter	0.35	0.96				
Pass-on	0.57	0.76				
Control	0.67	0.73				

The GLMs that were calculated show that the change in intention to use SODIS is significant over time ($F = 31.30$, $p < .001$, $df = 1$), area ($F = 32.36$, $p < .001$, $df = 2$) and

[1] All variables have been standardized from 0 to 1, with 0 being against the desired behaviour and 1 being supportive of the desired behaviour.

time*area (F = 94.12, $p < .001$, $df = 2$). Pair-wise comparisons of intervention areas show that the promoter-area does not differ significantly from the pass-on-area, but both differ significantly from the control ($p < .001$). Table 2 and these analysis show that the intention increases due to promoters, stays on the same level in the pass-on-task area and decreases in the control area. Because the pair-wise comparison showed that there is no difference between promoters and pass-on-task, both seem to keep the intention more or less constant.

The subjective norm (how other people are perceived to think about the use of SODIS) changes significantly over time (F = 26.72, $p < .001$, $df = 1$), area (F = 10.11, $p < .001$, $df = 2$) and time*area (F = 8.83, $p < .001$, $df = 2$). Pair-wise comparisons of intervention areas reveal that the change in subjective norm in the promoter area does not differ significantly from that in the control area, but from the pass-on-area ($p < .001$). The pass-on-area differs significantly from the control area ($p = .001$). Whereas the subjective norm becomes stronger in the promoter and pass-on-areas, it decreases in the control area.

For behavioural control, the change over time is significant (F = 228.55, $p < .001$, $df = 1$), as is the change due to area (F = 4.79, $p = .009$, $df = 2$) and the interaction effect time*area (F = 6.98, $p = .001$, $df = 2$) are not. Pair-wise comparisons of intervention areas reveal that the change in behavioural control is only marginally different between promoters and pass-on-task ($p = .075$). The pass-on-task differs significantly from the control ($p = .013$), but control and promoters are not significantly different. The behavioural control becomes more positive (doing SODIS becomes easier) in all three areas, but most so in the areas of promoters and the control.

For the conviction about how time-consuming SODIS is, the change over time is significant (F = 1152.70, $p < .001$, $df = 1$), but the change due to area (F = 2.07, $p = .139$, $df = 4$) and the interaction effect time*area (F = 1.65, $p = .204$, $df = 2$) are not. So all three areas become

more positive in their estimate that SODIS is taking very little time to prepare, no matter what kind of intervention (or any intervention at all) was applied, just with experience.

For the conviction about how much money SODIS costs, the change over time is significant ($F = 4733.79$, $p < .001$, $df = 1$), as is the change due to area ($F = 37.36$, $p < .001$, $df = 2$) and the interaction effect time*area ($F = 24.96$, $p < .001$, $df = 2$). Pair-wise comparisons of intervention areas show that the area where the pass-on-task was applied is not significantly different from the control area, but all other pairings are ($p < .001$). All three areas become more positive in their conviction that SODIS is cheap, but the change is most positive in the promoter area, whereas there is no difference between the pass-on-task and the control.

For the conviction about how SODIS tastes, the change over time is significant ($F = 1775.65$, $p < .001$, $df = 1$), as is the change due to area ($F = 39.64$, $p < .001$, $df = 2$) and the interaction effect time*area ($F = 15.19$, $p < .001$, $df = 2$). Pair-wise comparisons of intervention areas show that the area where the pass-on-task was applied is not significantly different from the control area, but all other pairing are ($p < .001$). All three areas become more positive in their conviction that SODIS tastes good, but the change is most positive in the promoter area, while there is no difference between the pass-on-task and the control.

The change over time of habit is significant ($F = 6.08$, $p = .013$, $df = 1$), but the change due to area is not ($F = 1.29$, $p = .286$, $df = 2$). The interaction effect time*area is marginally significant ($F = 3.04$, $p = .058$, $df = 2$). Habit decreases in the pass-on- and control-areas, but increases in the promoter area (tendency of interaction effect between area and time).

For the factor “frequency of talking”, the change over time is highly significant ($F = 225.69$, $p < .001$, $df = 1$), as is the change due to area ($F = 12.52$, $p < .001$, $df = 2$) and the interaction effect time*area ($F = 8.11$, $p < .001$, $df = 2$). Pair-wise comparisons of intervention areas shows that the pass-on-area does not differ significantly from the control area, but the

promoter area does differ significantly from the pass-on-area and the control ($p < .001$). That means, where promoters are employed, people are influenced to talk most about SODIS; the pass-on-task and control areas increase in the same way and they do not increase as much as the promoter-area.

Knowledge does not change significantly due to time ($F = 1.40$, $p = .239$, $df = 1$), but due to area ($F = 13.30$, $p < .001$, $df = 2$) and the interaction effect time*area ($F = 31.41$, $p < .001$, $df = 2$). Pair-wise comparisons of intervention areas shows that the pass-on-area does not differ significantly from the control area, but the promoter area does differ significantly from the pass-on-area and the control ($p < .010$). The strong differences in knowledge at the baseline rules out the differences between pass-on-area and control, although table 2 shows that knowledge in the pass-on-area increases, while it is decreasing in the control area and staying relatively constant (decreasing slightly) in the promoter area.

Tension about forgetting changes significantly due to time ($F = 132.77$, $p < .001$, $df = 1$), but not due to area ($F = .88$, $p = .418$, $df = 2$), while the interaction effect time*area is significant ($F = 69.64$, $p < .001$, $df = 2$). Table 2 shows that people in all areas increase in the tension that is felt when forgetting to prepare SODIS.

The first thing that can be noted is that the interventions increase all the factors. The only exception is habit, which decreases from baseline to T1 for pass-on and control. Other decreasing of factors is only taking place in the control condition, for the factors intention and subjective norm.

Whereas the promoters have a similar effect on the intention to do SODIS and the subjective norm as the pass-on-task does, the conviction about costs, the conviction about taste, the behavioural control and the frequency of talking is changed better by the work of promoters. Conviction time, habit and tension about forgetting are changed in the same way by both

interventions and the control area. The pass-on-task works better than the promoter-strategy for improving the knowledge and as good in improving the intention and the subjective norm.

Next, the second phase of interventions will be analyzed. The effects of prompts versus public commitment versus "knowledge & tension strategy" versus pass-on versus control will be examined. Please see table 3 for the means for each factor and each area for T1 (after first intervention) and T2 (after second interventions).

Table 8: [Table 3 in Study 2] Means for each area (prompt versus public commitment versus pass-on-task versus "knowledge & tension strategy" (=kn & t str) versus control) for each selected behaviour-influencing factor for point of time 1 (after first intervention) and point of time 2 (after second intervention).[1]

Promotion strategy	M_{T1}	M_{T2}	M_{T1}	M_{T2}	M_{T1}	M_{T2}
	Intention		Subjective Norm		Behavioural control	
1: prompt	0.94	0.86	0.92	0.95	0.98	0.97
2: public com	0.90	0.97	0.84	0.97	0.95	0.98
3: pass-on	0.86	0.35	0.64	0.71	0.94	0.83
4: knowledge	0.79	0.81	0.81	0.97	0.77	0.98
5: control	0.56	0.33	0.70	0.75	0.90	0.70
	Conviction time		Conviction costs		Conviction taste	
1: prompt	0.99	1.00	0.98	0.97	0.75	0.96
2: public com	0.99	0.99	0.98	0.99	0.77	0.98
3: pass-on	0.94	0.99	0.93	0.92	0.60	0.97
4: knowledge	0.79	0.98	0.71	0.80	0.66	0.94
5: control	0.97	0.96	0.88	0.83	0.57	0.93
	Habit		Frequency of talking		Knowledge	
1: prompt	0.95	0.96	0.90	0.93	0.78	0.99
2: public com	0.91	0.96	0.84	0.97	0.91	0.99
3: pass-on	0.81	0.60	0.83	0.47	0.89	0.87
4: knowledge	0.55	0.57	0.69	0.73	0.82	0.99
5: control	0.75	0.58	0.68	0.42	0.69	0.97

[1] All variables have been standardized from 0 to 1, with 0 being against the desired behaviour and 1 being supportive of the desired behaviour.

	Tension	
1: prompt	0.96	0.92
2: public com	0.96	0.85
3: pass-on	0.92	0.61
4: knowledge	0.67	0.62
5: control	0.73	0.63

The intention to do SODIS changes significantly over time (F = 115.13, $p < .001$, $df = 1$), due to the area (F = 140.19, $p < .001$, $df = 4$) and with a significant interaction effect (F = 58.44, $p < .001$, $df = 4$). Pair-wise comparisons of intervention areas reveal that except of the areas 1 and 2 (prompt and public commitment), all other area-pairings are significantly different from each other ($p < .001$). Whereas the pass-on-task and the control condition have a negative effect on the intention to do SODIS in the future, the prompts, public commitment and the "knowledge & tension strategy" keep the intention on more or less the same level (with a slight decrease for prompts and a slight increase for "knowledge & tension strategy" and public commitment).

Subjective norm changes significantly over time (F = 63.16, $p < .001$, $df = 1$), due to area (F = 72.98, $p < .001$, $df = 4$) and time*area (F = 3.82, $p = .004$, $df = 4$). Pair-wise comparisons of intervention areas show that prompts, public commitment and "knowledge & tension strategy" do not differ in how they change the subjective norm, but they are different from the pass-on-task ($p < .001$) and the control ($p < .001$), which also differ from each other ($p < .001$). Public commitment, prompts and "knowledge & tension strategy" create a better increase in subjective norm than the pass-on-task and the control.

The change of how much behavioural control is perceived, or how difficult or effortful doing SODIS is perceived to be, shows a tendency of significance over time ($F = 3.11$, $p = .078$, $df = 1$), is significant over area ($F = 71.57$, $p < .001$, $df = 4$) and time*area ($F = 88.04$, $p < .001$, $df = 4$). Pair-wise comparisons of intervention areas reveal that the areas with the prompt and with the public commitment do not differ significantly from each other, neither do the pass-on-task and the control. All other comparisons are significantly different from each other ($p < .001$). Prompts and public commitment are staying stable in their positive perception of how difficult SODIS is, the area that received the intervention "knowledge & tension strategy" became more positive, while the control and the pass-on are decreasing in the perceived level of behavioural control.

Conviction time changes significantly over time ($F = 84.41$, $p < .001$, $df = 1$), significantly over area ($F = 129.17$, $p < .001$, $df = 4$) and time*area ($F = 98.72$, $p < .001$, $df = 4$). Pair-wise comparisons of intervention areas reveal that the areas with the prompt and with the public commitment do not differ significantly from each other, neither do the pass-on-task and the control. All other comparisons are significantly different from each other ($p < .003$). Prompts, public commitment, pass-on-task (increasing very slightly) and control areas are staying stable in their positive perception of how much time the preparation of SODIS needs. The "knowledge & tension strategy" area is increasing in positivity of that conviction, but that is only possible because this factor was not as high in these areas as it was in the other at T1.

Conviction cost does not change significantly over time ($F = .031$, $p = .861$, $df = 1$), but does change significantly due to area ($F = 112.64$, $p < .001$, $df = 4$) and time*area ($F = 9.77$, $p < .001$, $df = 4$). Pair-wise comparisons of intervention areas reveal that the areas with the prompt and with the public commitment do not differ significantly from each other, but all other comparisons do ($p < .003$). For the prompts and public commitment strategies, conviction money

stays constant at a high level (people keep on thinking that SODIS is cheap), at the pass-on-task area, conviction money stays constant at a slightly lower level. The conviction decreases in the control condition and increases in the "knowledge & tension strategy" condition which nevertheless is on the lowest level at T2, due to the low level at T1.

Conviction taste changes significantly over time ($F = 616.57$, $p < .001$, $df = 1$), significantly over area ($F = 20.55$, $p < .001$, $df = 4$) and time*area ($F = 10.68$, $p < .001$, $df = 4$). Pair-wise comparisons of intervention areas show that prompt and public commitment do not differ from each other. "Knowledge & tension strategy", pass-on-task and control do also not differ from each other. All other comparisons are significantly different from each other ($p < .003$). All intervention strategy areas are increasing the conviction taste. The areas prompts and public commitment were higher in the conviction about taste at T1 than the other three areas, but the conviction at T2 is equally high in all areas.

Habit changes significantly over time ($F = 7.23$, $p = .007$, $df = 1$), area ($F = 239.30$, $p < .001$, $df = 4$) and time*area ($F = 11.23$, $p < .001$, $df = 4$). Pair-wise comparisons of intervention areas show that the area with the prompt does not differ significantly from the area with the public commitment strategy and habit in the "knowledge & tension strategy" area does not differ from the control area. All other areas differ significantly from each other ($p < .001$ / pass-on versus control $p = .015$). Whereas prompts and public commitment work equally good for supporting the habit (keeping it constant on a high level), the "knowledge & tension strategy" and the control condition keep habit constant on a lower level (habit decreases slightly in the control condition) and habit decreases in the pass-on-task-area.

The frequency of talking about SODIS is changing significantly over time ($F = 46.26$, $p < .001$, $df = 1$), due to the intervention area ($F = 134.17$, $p < .001$, $df = 4$) and with a significant interaction effect between time and area ($F = 63.53$, $p < .001$, $df = 4$). Pair-wise

comparisons of intervention areas reveal that except of the areas 1 and 2 (prompt and public commitment), all other pairings of areas are significantly different from each other ($p < .001$). Prompts and public commitment are increasing the talking frequency on a high level, "knowledge & tension strategy" is increasing the talking on a lower level. The talking frequency decreases in the pass-on-task area and control.

The knowledge of how safe the raw water is, is changing significantly over time ($F = 78.74$, $p < .001$, $df = 1$), due to the intervention area ($F = 6.50$, $p < .001$, $df = 4$) and with a significant interaction effect between time and area ($F = 10.12$, $p < .001$, $df = 4$). Pair-wise comparisons of intervention areas show that prompts, public commitment and "knowledge & tension strategy" are not differing significantly. All other pairings differ significantly ($p < .001$). Prompts, public commitment and "knowledge & tension strategy" increase the knowledge. In the control area, knowledge also increases. Knowledge decreases very slightly in the pass-on-task area.

The tension that someone feels about forgetting to use SODIS changes significantly over time ($F = 80.25$, $p < .001$, $df = 1$), due to area ($F = 108.43$, $p < .001$, $df = 4$) and time*area ($F = 9.15$, $p < .001$, $df = 4$). Pair-wise comparisons of intervention areas show that areas 1 and 2 (prompt and public commitment) do not differ significantly from each other and areas 3 and 5 (pass-on-task and control) and 4 and 5 ("knowledge & tension strategy" and control) do not differ significantly from each other. All other pairings of areas are significantly different from each other ($p < .001$). The tension that is felt over forgetting to do SODIS is decreasing in all areas, but less so in areas 1 and 2 (prompt and public commitment). The decrease in the "knowledge & tension strategy" area is similar to areas 1 and 2, but the tension there was lower to begin with (at T1). Where the pass-on-task is used, the tension decreases most strongly.

Each intervention that was used influences specific factors differently. Prompts showed very much the same effect as public commitment. These two strategies work best for increasing the subjective norm, conviction taste and knowledge. They keep the intention, the behavioural control, the conviction about costs, habit and frequency of talking on a constant positive level. Where prompts or public commitment have been used, only the tension about forgetting to prepare SODIS decreases, but this factor decreases in all areas, the least so in the prompt and public commitment areas.

The "knowledge and tension strategy" worked better than the pass-on-task or compared to the control condition and less good than prompts or public commitment in most cases. The "knowledge and tension strategy" works best for improving the behavioural control (better than prompts or public commitment) and the least good for conviction time, which it keeps constant, but on the lowest level of all intervention strategies. Additionally, the "knowledge and tension strategy" does work equally good for increasing the knowledge as prompts or public commitment. The tension that is felt when forgetting to do SODIS is not influenced best by the "knowledge & tension strategy", but by prompts and pubic commitment. The pass-on-task was not working best for any of the analyzed factors, except conviction time (which can only be changed more positively by the pass-on-task and the control because it was on a lower level to begin with). Compared to the control condition, it is better for the intention (which nevertheless decreases), for the conviction about costs and for the frequency of talking (which also decreases). For tension, knowledge, and habit, it even works less well compared to the control condition.

Overall, it can be noted, that for the time span from T1 to T2, more factors are decreasing than has been the case from baseline to T1. The intention decreases in the pass-on and control conditions, behavioural control decreases in the pass-on and control conditions,

conviction about costs decreases in the control condition, habit decreases in the pass-on-task area, frequency of talking decreases in the pass-on and control conditions and knowledge as well as tension decrease in the pass-on-area.

Discussion

Interpretation of Results

The first research question that we asked was: "Does the behaviour in question change over time due to the interventions?". This can be answered positively. The behaviour changes over time: the number of regular SODIS users, although it is already slightly different at the time of the baseline study, changes more distinctively over time. The increase in users is significantly different, depending on the kind of intervention that was applied. After the first set of interventions, those areas which received the same intervention (area 1 and 2 was attended to by promoters, in areas 3 and 4, a pass-on-task was introduced) do not differ, but they differ between each other and from the control group. The strongest increase in number of users was achieved with the help of promoters. The pass-on-task brought about more users than the control condition.

After the second set of interventions, the differences are even more pronounced. Prompts and public commitment seemed to have a similar effect - both probably worked as memory aids. These two strategies are different from the other two ("knowledge & tension strategy" and pass-on) and from the control group. At first glance, the "knowledge & tension strategy" and the pass-on-task seemed to have had the same effect. The number of regular SODIS users does not differ. Further analysis shows that the number of irregular users differs strongly between those two strategies. The "knowledge & tension strategy" produced far more irregular users than the pass-on-task. Both are different from the control condition.

Analyzing the change over time in the percentage of SODIS water of the overall drinking water shows that the change over time in the percentage of SODIS water consumed is significant. From the baseline to after the second intervention, the proportion of SODIS increases strongly: From an average of 7% of SODIS water at the time of the baseline to an average of 76% of SODIS water in the intervention areas. The change due to intervention area and the interaction between time and intervention area is also significant, with some of the interventions working better than the others. Like for the number of users, the promoters increase the percentage of SODIS water consumed more strongly than the pass-on-task, but both works better than the control condition. Prompts, public commitment and the "knowledge & tension strategy" work better than the pass-on-task and the control condition.

This shows that the number of users as well as how much SODIS water the users consume is influenced by the kind of intervention applied. Although the pass-on-task seemed to be a good idea to spread SODIS without needing a lot of resources, pass-on alone does not work. The results in the area where it was combined with spreading knowledge and arousing dissonance about not doing SODIS ("knowledge and tension strategy"; with the help of promoters), on the other hand, are promising. If the information about SODIS is first given by promoters and then a memory-aiding technique like prompts or public commitment is handed out, high numbers of users (an average of 97% in area 1 and 2) whose SODIS consumption is high (on average 92% of their whole drinking water), can be achieved.

The next research question is "How do the interventions change factors that underlie the observed behaviour change?". For that, widely-used behaviour-influencing factors were selected and the impact of the different interventions on these factors was analyzed. This analysis showed that each intervention that was used influences different factors differently.

From baseline survey to survey after the first intervention (T1): First, it can be noted that the interventions increase all the factors. The only exception is habit, which decreases from baseline to T1 for pass-on-task and control condition. Other decreasing of factors is only taking place in the control condition, for the factors intention and subjective norm.

Whereas the promoters have a similar effect on the intention to do SODIS and the subjective norm as the pass-on-task, the conviction about costs, the conviction about taste, the behavioural control and the frequency of talking is changed better by the work of promoters. Conviction time, habit and tension about forgetting are changed in the same way by all three interventions. The pass-on-task works better than the promoter-strategy for improving the subjective norm and the knowledge.

Whereas the pass-on-task has a similar effect on the intention to do SODIS and on the subjective norm as the promoters do, the frequency of talking is increased most by the work of promoters. That the frequency of talking about SODIS is changed more strongly by the promoters than the pass-on-task is unfortunately exactly the opposite of the intended effect. The pass-on-task was intended to animate people to talk with friends and neighbours about SODIS, so that not so many promoters would be needed to disseminate SODIS in an area.

The convictions are changing most positively due to the promoter work (in comparison to the pass-on-task and the control condition), except of the conviction about time-consumption, which changed in the same way for promoters, pass-on-task and control. This points to promoters being more persuasive than neighbours or friends (because with the pass-on-task, most people will hear about SODIS from friends or neighbours, not from official promoters). It also shows that the experience with SODIS does not considerably change the perception about how much time it takes - SODIS just does not take a lot of time to prepare.

These results are in line with the expectations. Promoters were expected to have a strong influence on convictions and on the subjective norm, which was confirmed with the given results. Except conviction time, which changes to the positive in all areas. Thus, the conviction about time is not dependent on interventions - SODIS just takes little time and that becomes obvious to people after a short time and some experience with SODIS.

The pass-on-task was meant to increase the talking about SODIS, the convictions and the subjective norm. The subjective norm is changed well by the pass-on-task (as good as by promoters), while the convictions (except conviction time) and the talking frequency are not changed most positively by the pass-on-task, but by the promoters. The pass-on-task did increase the talking frequency, just not as well as the promoter-work. This points out that a pass-on-task alone might not be as effective as expected and thus may need supplementary action.

From after the first intervention (T1) to after the second intervention (T2): Each intervention that was used influences different factors differently. Prompts showed very much the same effect as public commitment. These two strategies work best for increasing the subjective norm, conviction taste, knowledge and frequency of talking. They keep the intention, the behavioural control, the conviction about costs, convictions about time and habit on a constant positive level. Where prompts or public commitment have been used, only the tension about forgetting to prepare SODIS decreases, but this factor decreases in all areas, the least so in the prompt and public commitment areas.

The “knowledge and tension strategy” worked better than the pass-on-task or the control condition and less good than prompts or public commitment in most cases. The “knowledge and tension strategy” works best for improving the behavioural control (better than prompts or public commitment) and the least good for conviction time, which it keeps constant, but on the lowest level of all intervention strategies. Additionally, the “knowledge and tension

strategy" does work equally good for increasing the knowledge as prompts or public commitment. The tension that is felt when forgetting to do SODIS is not influenced best by the "knowledge & tension strategy", but by prompts and public commitment.

The pass-on-task was not working best for any of the analyzed factors. It only worked better than the control condition for the intention (which nevertheless decreases), for the conviction about costs and for the frequency of talking (which also decreases). For tension, knowledge and habit, it even works less well than the control condition.

Overall, it can be noted that for the time span from T1 to T2, more factors are decreasing than has been the case from baseline to T1. The intention decreases in the pass-on and control conditions, behavioural control decreases in the pass-on and control conditions, conviction about costs decreases in the control condition, habit decreases in the pass-on-task area, frequency of talking decreases in the pass-on and control conditions and knowledge as well as tension decrease in the pass-on-area.

It was expected that prompts should mainly increase the habit, behavioural control and the intention to use SODIS. Public commitments should have an impact on the intention, subjective norm and on the frequency of talking. Interestingly, both memory aids had the same main impact on subjective norm, conviction taste and knowledge. The intention, the behavioural control, conviction cost, habit and frequency of talking are kept constant and although the tension decreases, it decreases the least of all strategies with memory aids. Thus, memory aids in general seem to have a widespread effect on many different factors. Obviously, a memory aid would work through increasing the habit and the intention to do the task one is reminded to do. Seeing these memory aids all the time (either the prompt in a prominent spot inside the home or the public commitment whenever the home is left or entered), points out the dissonance between the intention to prepare SODIS and forgetting to do it. That way, tension is created and maintained.

This, in turn, probably also increases the intention and the habit of doing SODIS. The social aspect (subjective norm and frequency of talking) is reached, when other people see the public commitment or the prompt (guests in the house). The subjective norm becomes more salient in this case. The convictions might change due to the general commitment to and experience with SODIS and maybe due to a self-persuasive effect of frequent communication about SODIS.

It was expected that the "knowledge & tension strategy" should influence the habit and mainly the tension about forgetting to prepare SODIS. The dissonance or tension that is felt when forgetting to do SODIS is unexpectedly not changed the most by the "knowledge & tension strategy", but by prompts and public commitment. This can be explained with prompts and public commitment working as memory aids, constantly reminding that one *should* prepare SODIS and thus creating tension if it is not done. How it can be explained why this tension seems to be stronger than a tension-arousing question, will be discussed in the section "Implications for practice" further on in the text. The better understanding or knowledge that comes with the intervention "knowledge & tension strategy" leads to more behavioural control - SODIS is perceived to be easier to perform than before the intervention. The promoter "lecturing" about why and how water can be unsafe, what can be done about it, how easy it is to do and then asking "Are you doing SODIS" is like presenting a subjective norm, so it is not surprising that it increases this factor.

The pass-on-task was expected to increase the talking about SODIS and with that, the convictions and subjective norm. Unfortunately, the pass-on-task did not meet these expectations. It did not increase the talking about SODIS further. The convictions thus just stayed constant (conviction taste increases) and the subjective norm increases, but only the conviction cost is influenced better by the pass-on-task than the control.

The overall question that this paper aimed to answer is: “Do the interventions which were used change behaviour and how?”. The interventions that were used in this study clearly change behaviour and behaviour-changing factors, and they do so to different degrees.

Strength and Weaknesses of the Study

Since the study at hand is a field study, certain limitations quite naturally derive from that fact. One of those limitations is that it would be ethically questionable if we would forbid the interviewers to tell the people in the control condition about SODIS. Thus, there is a higher percentage of SODIS users than there would otherwise be in an area that does not receive any promotional intervention. When the interviewers explain how SODIS works, that does have an influence on the interviewees which is probably quite similar to (even if not as strong as) a promoter visit. It is also not quite clear how much influence the interviewers exert on the interviewees deliberately, since they view themselves as community workers more than as researchers. It is therefore very important to train the interviewers profoundly, so that their contact with the interviewees stays like that of an observer more than of someone interfering with their lives.

Another limitation of this field study is the control of the interventions. We only found out after the interviews that many of the interviewees did not understand when they were asked for tokens, stickers (the prompts) or even flyers. Thus, we were not able to receive realistic numbers of who received which materials. As a consequence, we had to rely on the honesty and accuracy of the promoters when they indicated which areas they had covered. In future, the terms to be used in intervention check questions should be cleared up with the interviewees from the area and the promoters before the interviews are implemented.

The interventions used were very successful in creating a high number of users with a high SODIS consumption and a positive opinion about SODIS. Additionally, in area 1 and 2 (where promoters and memory aids have been applied), the number of users is almost not changing from after the first intervention to after the second intervention. This can be viewed as a success for the interventions, as it has been found in past studies that the number of users decreases with time (Tamas, Tobias, & Mosler, 2009). A habit to prepare SODIS has successfully been built up with these strategies, as the analysis of the effect of the interventions on the factors show.

The main achievement of this paper is to show the effectiveness and differences between the interventions and which factors are influenced by them. The study at hand is innovative in it's looking at the behaviour change factors and how these factors are changed by the interventions.

Implications for Practice

To engage promoters to spread the word about SODIS proves to be a very effective method in introducing SODIS and getting people to use it. Part of the success of this method in the case of the study at hand might have been that the promoters were receiving salaries, were very motivated and clearly influential and respected people of the community. It also seems that promoters were using tailored interventions as propagated by Mosler and Martens (2008), which means that they were trying to convince according to recipients characteristics. To avoid the loss of users and of percentage of usage, memory aids like prompts and public commitment were shown to work very well. This method is very simple (in this case, stickers were developed and distributed to every household which only takes a few days, depending on the size of the area) and cost-effective, because very little human resources are needed.

Memory aids might have been so effective, because of the living circumstances of people. Mostly, inhabitants of the project areas do not have a lot of decoration in their houses or huts. That is why a prompt would stand out much more than it does in a highly distractive environment like in other countries.

The pass-on-task was developed to further increase the effectiveness of the dissemination of SODIS. With a successful pass-on-task, very few promoters would be needed and the effect could be long-lasting and wide-spread, if people keep on telling each other about this beneficial water treatment method. Unfortunately, the pass-on-task alone has not proven to be working - users are even quitting SODIS, if the attendance by official representatives is not increased.

In the area where promoters use the strategy where they spread knowledge about water contamination and treatment and induce tension (by emphasizing the dissonance between the required and the actual behaviour) after a pass-on-task has been employed in the first step, does increase in user numbers, even though these users are only irregular users. It should be possible to turn these irregular users into regular users with the help of a memory aid or habit-building technique. To avoid the high number of irregular users, it could be advisable to use the promoters first and then the pass-on-task.

Although the strategy of disseminating knowledge and creating tension ("knowledge & tension strategy") works in increasing the number of users, it might be preferable to use a dissemination of knowledge with the help of persuasion instead. There should be caution in arousing dissonance, as it can cause reactance. Maybe the high number of irregular users (as opposed to the regular users in the other promoter areas) might point to that effect: people feel almost forced to use SODIS, it is not an internal motivation. To avoid the unpleasant dissonance, SODIS is used, but not regularly. The dissonance that is created by the prompts and the public

commitment might be one of a different kind: instead of comparing my behaviour with an external request (like in the case of the "knowledge & tension strategy"), the request is a more internal one (when I see the memory aid, I am reminded of my own intention to use SODIS). That might be why the effect on tension of the interventions prompt and public commitment is stronger than the effect of the intervention "knowledge & tension strategy". This effect of "internal versus external dissonance" which was induced might be an interesting subject for future research.

Conclusion and Outlook

Disseminating information about SODIS and its advantages with the help of promoters coupled with a habit building strategy like a memory aid (prompt or public commitment) is a very effective and efficient way of spreading the use of SODIS. High numbers of users with a high proportion of treated water consumed can be reached this way.

The pass-on-task (a strategy that was developed to spread SODIS with the help of inhabitants by way of telling friends and neighbours about SODIS and centralizing the expertise and information-giving at a bottle centre) did not show the expected results. It does not seem convincing enough (promoters have a broader effect on the convictions relating to SODIS). This could be changed by coupling an information event with the pass-on-task. People receive their information first-hand from experts and are then more credible when they pass the information on to others. The group of trustworthy "talkers" could be increased considerably this way.

Pairing the pass-on-task with one promoter intervention looks promising. To use the promoter intervention first and then the pass-on-task could be the way of linking the effective promoter-method with the even more cost-efficient pass-on-task. This would not only be more efficient, but also spread the word of SODIS farther (over the boundaries of the intervention

areas). One more possibility of improving the pass-on-task could be to enhance it with incentives. For example with a competition where those people who talk most about SODIS to others can win something.

The study at hand shows that it is worth it to analyze the strategies used. We hope that this kind of research finds a broad application in campaign work and helps to increase their effectiveness and efficiency.

Study 3:

Differentiating between User Types and Relapsers of Solar Water Disinfection in a Long-Term Study in Zimbabwe

Abstract

Solar water disinfection (SODIS) is a household water treatment technique that could prevent millions of deaths caused by diarrhoea. While promotion campaigns are at least partially effective, people do not use SODIS regularly, or they relapse into non-use. According to the five stages of the Transtheoretical Model of Change (TTM), psychological factors are elaborated that differentiate between types of users and relapsers. We use the factors of perceived need, attitude, intention and habit to differentiate between non-users, fluctuaters, irregular users, regular users, relapsers (all user types derived from TTM) and late beginners (a user type identified by analyses). Results of a four-point panel study conducted over one and a half years in Zimbabwe reveal that non-users have a lower value in nearly all the examined factors than the other user groups. Distinguishing factors between the other groups were identified. Once it is known which factor(s) drive the development from one stage or user group to the other, these factors can be used for interventions. From these results, implications for long-term campaigns are drawn with the aim of bringing all types of users to a regular use of SODIS.

Keywords: solar water disinfection, user groups, Transtheoretical Model of Change, longitudinal study, adoption, habit, attitude

Introduction[1]

Although clean water is a human right, 1.1 billion people worldwide still live without access to safe drinking water (WHO, 2006a). About 1.8 million people die from diarrhoeal illnesses every year (WHO, 2007), illnesses that are mainly due to a lack of safe drinking water, sanitation and hygiene. Many more deaths could be avoided and living conditions improved by enabling access to safe drinking water. Boiling is a common method of treating unsafe water to avoid diseases. However, this uses a lot of natural and human resources, requiring fuel (wood or gas), time and effort. A more sustainable way of treating water is solar water disinfection (SODIS), which makes use of sunlight and plastic bottles. In SODIS, a waste product (used plastic bottles) and the sun is used to treat drinking water instead of wood or gas for boiling or chemicals for disinfecting.

SODIS is a pro-poor household-based water treatment method. PET bottles filled with water are exposed to sunlight for six hours (or two consecutive days if it is more than 50% cloudy). This procedure inactivates pathogens that are responsible for waterborne diseases like diarrhoea, dysentery and cholera (Berney, Weilenmann, Simonetti, & Egli, 2006; Joyce, McGuigan, Elmore-Meegan, & Conroy, 1996; Wegelin et al., 1994). The sunlight destroys these pathogenic micro organisms through two mechanisms, namely UV-A radiation (wavelength 320–400 nm) and increased water temperature (Meierhofer & Wegelin, 2002). The consumption of SODIS-treated water significantly reduces diarrhoea rates in people who were previously consuming untreated water (Conroy, Meegan, Joyce, McGuigan, & Barnes, 2001; Rose et al., 2006). However, Graf, Meierhofer, Wegelin, and Mosler (2008) and Altherr, Mosler, Tobias, and

[1] This study was accepted for publication: Kraemer, S. M., & Mosler, H.-J. (accepted). Differentiating between User Types and Relapsers of Solar Water Disinfection in a Long-Term Study in Zimbabwe. *Journal of Health Psychology.*

Butera (2008) were able to show that the protective effect of safe water in children under five years only occurred when a high percentage of safe water was consumed.

The low cost of the application of SODIS is particularly important for people who have no access to other methods of water treatment because of their high cost (e.g., wood or fossil fuels) or the non-availability of resources needed for the application. In addition, by contributing to overall health, SODIS creates economic benefits by making more working days available and saving money for medication.

In spite of these obvious advantages, SODIS is typically not as widely or immediately used as one would expect, considering its beneficialness (Moser, Heri, & Mosler, 2005; Tamas, Tobias, & Mosler, 2009). Additionally, not everyone who adopts SODIS does so to the same amount. For example, some users estimate themselves as being irregular in their use, while some use SODIS for a while, stop and then use it again. Others never start using SODIS even though they live in a campaign area; some use SODIS for a few months and then suddenly stop, or they do not use it for several months and then suddenly start. To understand what determines to which group a person belongs can help shape more appropriate campaigns in the future. Therefore, it is important to understand the differences between someone who uses SODIS regularly and to a high percentage and other kinds of users. These differences should manifest themselves in certain psychological variables.

The Transtheoretical Model of Change (TTM) (Prochaska & DiClemente, 1983) provides a theoretical background for classifying the change process in such a health behaviour. This theory enables the classification of user groups according to their stage in the change process and provides the variables that identify these groups. To date, research has provided strong evidence for the validity of the model and its stages of change (e.g., McConnaughy, DiClemente, Prochaska, & Velicer, 1989; Prochaska & DiClemente, 1992; Radowski, 1996;

Velicer & Prochaska, 2008), and its applicability has been tested in a wide range of health behaviours such as smoking (Velicer, Prochaska, & Redding, 2006), sun-protection (Prochaska et al., 2004) and stress management (Evers et al., 2006).

According to Prochaska and DiClemente's (1982, 1983) groundbreaking stage model, the Transtheoretical Model of Change, change in health behaviour follows five stages: (a) precontemplation, (b) contemplation, (c) action, (d) maintenance and (e) relapse. These different stages characterize the process of change a person may be in and define the attributes of that person. In their application of the model to smoking behaviour, Prochaska and DiClemente (1983) state that, depending on certain attributes of the smoker and the smoking behaviour, smokers in the change process of quitting can be classified according to the stages of the model: immotives (precontemplation stage: no intention to quit), contemplators (contemplation stage: thinking about quitting), recent quitters (action stage: quit smoking within the last six months), long-term quitters (maintenance stage: non-smoking for more than six months) and relapsers (relapse stage: failed to quit).

This categorization can serve as an example for the classification of different SODIS user groups to their corresponding stage of the change process. In this study, the subjects were grouped according to their SODIS behaviour over the course of a long-term-study lasting longer than one and a half years (and consisting of four panel interviews). The groups hypothesized are identical to those in the aforementioned study (Prochaska & DiClemente, 1983), with the same attributes, applied instead to SODIS behaviour. In the following sections, the stages, user types and their attributes will be explained in detail and applied to SODIS behaviour.

Precontemplation: People in the precontemplation stage are reluctant to change. They are defensive about changing their thinking or their behaviour. Thus, they stay with the initial rather than the targeted behaviour because they are content with the situation as it is

(Prochaska & DiClemente, 1983). No *need* for change is acknowledged or seen (Prochaska & DiClemente, 1982). In this case, the immotives should be SODIS non-users, because they will have never changed their behaviour towards the preferable water treatment behaviour. Hence, SODIS non-users should not see a need to change their current behaviour of consuming raw water.

Contemplation: In this stage, people are thinking about changing and are looking for information. They have acknowledged that there is a problem but have not yet made up their minds about what to do (Prochaska & DiClemente, 1982). In other words, they see a need for change, but have not yet formed the behaviour-driving *attitude*. In terms of SODIS behaviour, the contemplators could be those who sometimes use SODIS but sometimes do not. They fluctuate between use and non-use and can therefore be called "fluctuaters." Fluctuaters should perceive a higher need for water treatment and already have a more positive attitude towards SODIS than the non-users in the precontemplation stage.

Action: People in the action phase are committed to changing their behaviour (Prochaska & DiClemente, 1983). Accordingly, they have seen that behaviour change is necessary, have made up their minds what action to take and now want to act (Prochaska & DiClemente, 1982). Thus, the *intention* to implement the behaviour is present during this stage. While people in this stage exhibit the targeted behaviour, they might not have developed the same stability as someone in the maintenance stage. This fits the groups of people who identified themselves as using SODIS only irregularly, not regularly every day, that is, the "irregular users." This group should have a stable high need, attitude and intention to use SODIS, particularly in comparison to earlier stages in the change process.

Maintenance: This stage is about sustaining the chosen behaviour over at least six months (Prochaska et al., 1994), hinting to a necessary *habit* to be developed for the long-term

upkeep of a changed behaviour (Prochaska & DiClemente, 1983). Thus, someone who is showing the SODIS behaviour regularly over the course of at least six months can be considered in the maintenance stage. “Regular users” are people who assess themselves as using SODIS regularly. When they do so over a longer time period, it can be assumed that they have developed the strong habit necessary for maintenance. The habit of regular users should thus be stronger than that of all other groups.

Relapse: People experience relapse when they fall back into the behaviour they were showing before they changed (Prochaska & DiClemente, 1983). Thus, relapse means failure to change. In this case, relapsers are those who had been using SODIS, but stopped. If a subject is not successful in maintaining the behaviour and thus becomes a relapser, then habit seems to be lacking.

As can be seen from the above descriptions, each stage of change is distinguishable by certain attributes manifested in subjects going through the stage. These attributes can be broken down into psychological variables that represent each stage; that is, need, attitude, intention and habit can be used to examine the differences between groups in different stages of the change process. If these stages, user-types and attributes are viewed in conjunction, the following research questions can be posed. Since it can be deduced that the user groups are consistent with the findings of Prochaska and DiClemente (1983), the attributes of the groups should follow this progression of stages as well. As the TTM is a hierarchical process model, each stage in the process should be distinguishable by another factor, and each factor should build on the preceding factor in order for a person to be able to move from one stage to the next.

Hypotheses

In accordance with the abovementioned classification, conclusions and chosen variables, the following hypotheses are stated:

(H Ia) Non-users are in the precontemplation stage and distinguishable from the next stage (fluctuaters) by a lower need.

(H Ib) Non-users have a low attitude and intention similar to fluctuaters.

(H IIa) Fluctuaters are in the contemplative stage and distinguishable from the next stage (irregular users) by a lower attitude.

(H IIb) Fluctuaters have a high need similar to irregular users, whereas their intention and habit are lower than those of irregular users and might fluctuate.

(H IIIa) Irregular users are in the action stage and distinguishable from the next stage (regular users) by a lower habit.

(H IIIb) Irregular users have a lower need, attitude and intention than regular users, but higher than the other groups.

(H IVa) Regular users are in the maintenance stage and distinguishable from the other groups by a higher habit.

(H IVb) Regular users have a higher need, attitude, intention and habit than the other groups.

(H Va) Relapsers are distinguishable from irregular users by a lower habit.

(H Vb) Relapsers have a high need and attitude similar to irregular users, but their intention and the habit are lower, especially after relapse.

Methods

Research Area

Field research was carried out in informal settlements in high-density areas around Harare. Harare is the capital of Zimbabwe, which currently has the highest inflation rate in the world and is thus very unstable economically. The municipal infrastructure, including water supply and sanitation, is relatively good, but the high-density areas and so-called informal settlements that grew after a governmental relocation of city residents in 2005, such as Epworth and Hopley Farm, widely lack access to sanitation and safe drinking water (Amnesty International, 2006). Only 47% of the 13 million inhabitants in the rural areas of Zimbabwe have access to improved sanitation, and 72% have access to improved drinking water sources. The mortality rate of children below five years of age is 10%. Of these, 12% die from diarrhoeal diseases (WHO, 2006a). These numbers are believed to be higher in the high-density areas and to increase rapidly with the deteriorating situation in Zimbabwe. As most people in these areas obtain their water from unsafe water sources such as (unprotected) wells and since secondary contamination is high and most people do not treat their water, these areas show great potential for a water treatment technique like SODIS (Murinda & Kraemer, 2008).

Procedure

Data was obtained by conducting structured interviews in the households of the interviewees. People took part in this study voluntarily and without receiving any compensation for participation. They were chosen randomly, by means of random route sampling (Hoffmeyer-Zlotnik, 2003). This means the interviewers (who were local citizens from around Harare and chosen on behalf of their qualifications and work experience) went to every third household on their way through their assigned area. That way, 10 interviewers completed between five and

eight interviews a day, with each one taking about 45 minutes. Interviews were held in Shona, the main native language of Zimbabwe. Over the course of 1.7 years, four interviews were conducted, each after a set of interventions. The first interviews (T1) took place in December 2007, the second (T2) in April 2008, the third (T3) in July 2008 and the last (T4) in September 2008. The intervals between the interviews were dependent on the kind of interventions and circumstances of fieldwork. The dropout rate was 28%; from $N = 693$ who took part in T1, $N = 514$ answered the interviews at all four points of time. This rate is so high because everyone who failed to take part in one of the four interviews was excluded. Interviews were held with the person in the household responsible for the drinking water of the members of the household.

The four interviews that are analysed here are part of a longer survey. The baseline interviews to the overall project took place in May 2007, two to three weeks after an informational event about SODIS in the respective areas. People were informed about these informational events by local leaders and through posters. Since these events were how some people heard about SODIS, the questionnaire began with questions about SODIS use, which led to a section with questions about details of its use for those who used SODIS or to general questions about drinking water, water sources, knowledge and convictions related to water treatment for those who did not use SODIS. If people had a preferred method of water treatment, they answered the next section about this method and were then asked general questions about health and hand washing. The next step was for the interviewers to provide standardized information about SODIS to the interviewees. This ensured that everyone could answer the next part, namely, the general questions about SODIS. Sections about communication, motivation, habits and network formed the last part of the questionnaire.

In October 2007, five months after the informational events, a first phase of interventions was carried out, based on findings from the baseline questionnaire. Three more

intervention phases were implemented, with a respective interview after each intervention, as outlined above. Since the intervention methods will not be analysed here, no further details will be explained. For information about the interventions, other publications are available (Kraemer & Mosler, in review, accepted).

Sample

At the beginning of this longitudinal survey, the participants in this field research were $N = 878$ inhabitants of high-density areas, $N = 364$ from Hopley Camp Farm, southwest of Harare and $N = 514$ from Epworth, southeast of Harare. The interviewees were $N = 802$ (91%) women and $N = 76$ men. The mean age was $M = 34$; the mean number of years of education were $M = 8$ years, and the mean income was $M = 400.000$ Zim$ (about 15 USD at that time) per month per household ($M = 4.5$ persons per household). This means that, on average, people in the research areas live far below the poverty line of 1 USD per day. Most people in the project areas are unemployed (24%), vendors (20%), informal traders (11%) or housewives (17%). On average, each household has one child ($M = 0.9$) below five years of age. For the following calculations, data from N = 514 subjects is utilized.

Questionnaire

Behaviour: User groups have been classified according to the following question: "Are you doing SODIS?" This question has four possible self-statement answers: (a) am doing SODIS regularly, (b) am doing SODIS sometimes or irregularly, (c) have tried SODIS but stopped, and (d) am not doing SODIS. To form groups, these answers were assessed over time. People who stated at all four time-points that they used SODIS regularly were grouped as "regular users." People who stated at all four time-points that they used SODIS either regularly or irregularly (with irregularly at a minimum of one time-point) were placed in the "irregular user"

group. Everyone who said at all four time-points that they did not use SODIS were termed "non-users." Users who fluctuated between categories (not using–using–not using) were placed in the "fluctuater" group. Individuals who used SODIS from T1 on, but then stopped at another time-point without picking the behaviour up again were termed "relapsers." During the analyses of the data, one new category was identified: "late beginners," who did not start using SODIS before T3, but then used it at least irregularly at the other time-points. Thus, late beginners represent an additional group.

Need: The perceived need for water treatment was measured according to answers to the question: "Do you see a need for water treatment?" Five answers were possible: (a) very much, (b) much, (c) quite a bit, (d) a little bit and (e) not at all.

Attitude: To measure attitude, a scale was constructed, consisting of answers to the following three questions: (1) "Do you think drinking SODIS water can make you healthier or less healthy?" with seven possible answers ranging from much healthier to neither healthier nor unhealthier to much unhealthier; (2) "How do you feel about SODIS?" with seven possible answers ranging from very positively to neither positively nor negatively to very negatively; and (3) "Do you think it is good or bad to do SODIS?" with seven possible answers ranging from very good to neither good nor bad to very bad. Cronbach's α varies from .70 to .87, depending on the point of time.

Intention: Intention to do SODIS was surveyed using the question: "Will you be doing SODIS regularly in the next two weeks?" Five answers were possible: (a) very probable, (b) probable, (c) quite probable, (d) slightly probable and (e) not probable.

Habit: Habit strength was measured with the following four questions: (1) "Is doing SODIS a habit for you?" with five possible answers: (a) very much, (b) much, (c) quite a bit, (d) a little bit and (e) not at all; (2) "How easy is it for you to remember to do SODIS?" with

answers ranging from very easy to not at all easy; (3) “Do other habits hinder you from doing SODIS?” with answer categories being (a) most of the time, (b) often, (c) sometimes, (d) rarely and (e) never; and (4) “How often does it happen that you intend to do SODIS and then forget to do so?” with the same answer possibilities as question (3). Cronbach’s α varies from .78 to .97, depending on the point of time.

All of the answers have been standardized to range from 0 to 1 or from -1 to +1 (in the case of bipolar variables). The answer that is most in favour of the behaviour is 1, and the answer that is most against the behaviour is 0 or -1 (in the case of bipolar variables). The bipolar variables have seven-point-scale answer categories, and the unipolar variables five-point-scales.

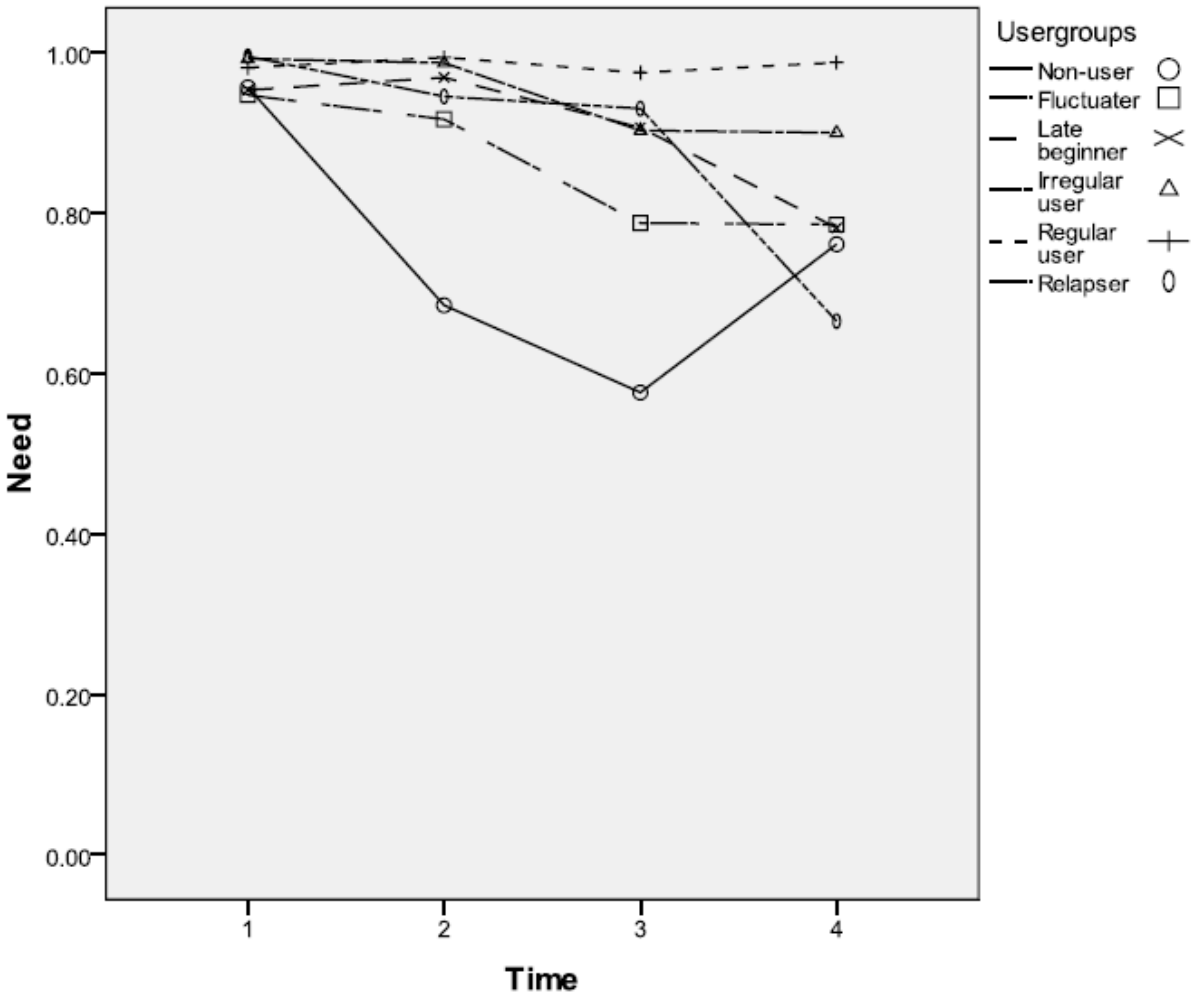
Results

First of all, the user groups classified according to the TTM had to be confirmed with data from this study. This was accomplished by assessing over time the answers to the question, “Are you doing SODIS?” People who stated all four times they were using SODIS regularly were grouped as “regular users” (n = 189). People who stated at all four points of time that they were using SODIS either regularly or irregularly (with at least one point of time irregularly) were placed in the “irregular user” group (n = 108). Everyone who said at all four points of time they did not use SODIS were compiled as the “non-users” (n = 54). Users who fluctuated between categories (i.e., not using–using–not using or using–not using–using) were put into the “fluctuater” group (n = 203). Individuals who used SODIS from T1 on, but then stopped at another point of time without picking up the behaviour again were grouped as the “relapsers” (n = 62). Additionally, one more group was found, consisting of people who did not fit in any other group: the “late beginners,” whose members did not start using SODIS before T3, but then use it at the other points of time at least irregularly (n = 65).

Altogether, this makes up a total of N = 682 subjects. The only subjects that could be used were those that answered all the questions at all points of time, leaving data from a total of $N = 514$ subjects, who answered the interviews at all four time-points. As these subjects still represent all user types, their data was utilized for analysis. Since questions about habit could not be answered by non-users, habit analysis was performed with $N = 491$ subjects. One GLM (general linear model) was done for each of the four TTM variables, comparing the different user groups (regular users, irregular users, late beginners, relapsers, fluctuaters and non-users) for four points of time. For all GLM analysis, the Greenhouse-Geisser F-value is discussed. Pair-wise analyses mentioned in the following GLM calculations are always the post-hoc Bonferroni method based on estimated marginal means. Significance levels of change over time, groups, the interaction effect of time*groups and the differences between the groups will be discussed following the figures.

Figure 1 shows the variation in time of the perceived need for water treatment. The calculated GLMs indicate that the change in need for water treatment is significant over time ($F = 73.75$, $p < .001$, $df = 2.69$) and by group ($F = 55.73$, $p < .001$, $df = 5$) and time*group ($F = 15.54$, $p < .001$, $df = 13.49$). Pair-wise comparisons of the groups show that all groups differ significantly from each other ($p < .007$). Exceptions include that irregular users are only marginally different from late beginners ($p = .065$) and that there is no significant difference between relapsers, fluctuaters and late beginners. In addition, Figure 1 shows that need is constantly high for regular users, decreases a little bit with time for the irregular users, is lower and decreases further with time for relapsers, late beginners and fluctuaters (in this order) and is lowest for non-users.

Figure 14: [Figure 1 in Study 3] Illustration of perceived need for water treatment for user groups over time.[1]



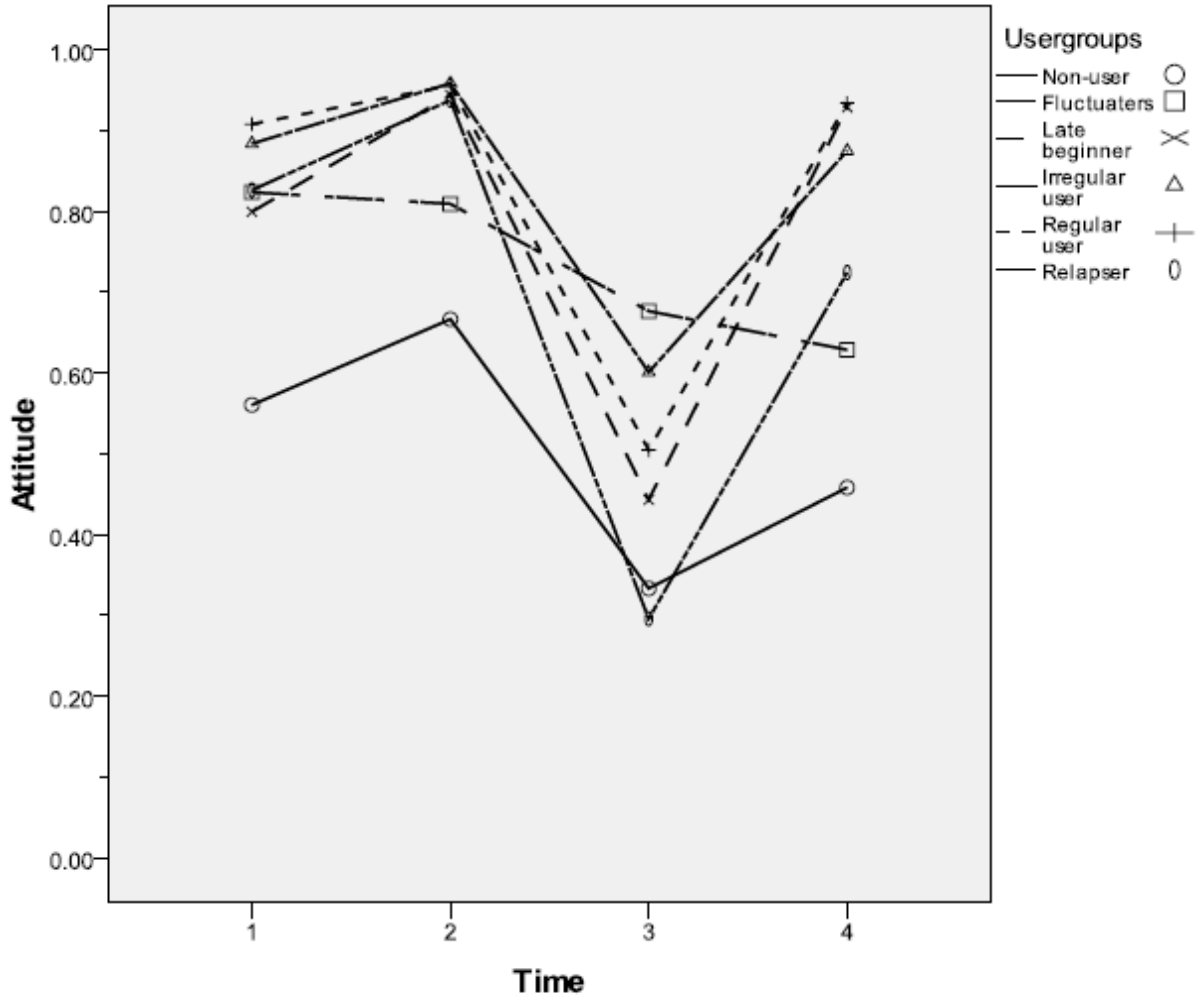
These facts support hypothesis Ia, that is, that non-users have a lower need than fluctuaters.

Attitude towards SODIS changes significantly over time (F = 109.91, $p < .001$, $df = 1.27$) and by group (F = 23.95, $p < .001$, $df = 5$) and time*group (F = 9.51, $p < .001$, $df = 6.37$). Pair-wise comparisons of user groups reveal that regular users, irregular users and late beginners do not differ significantly from each other and neither do late beginners, fluctuaters and relapsers. Other comparisons between groups are significant ($p < .001$). In all groups, attitude first rises (from T1 to T2), then decreases (T3) and then increases again (see Figure 2). The order

[1] Need is presented from 1 = very much to 0 = no need. Time is delineated from 1 = Panel 1 to 4 = Panel 4.

of the positivity in attitude is regular users, irregular users, late beginners, relapsers, fluctuaters and non-users.

Figure 15: [Figure 2 in Study 3] Illustration of attitude towards SODIS for user groups over time. [1]



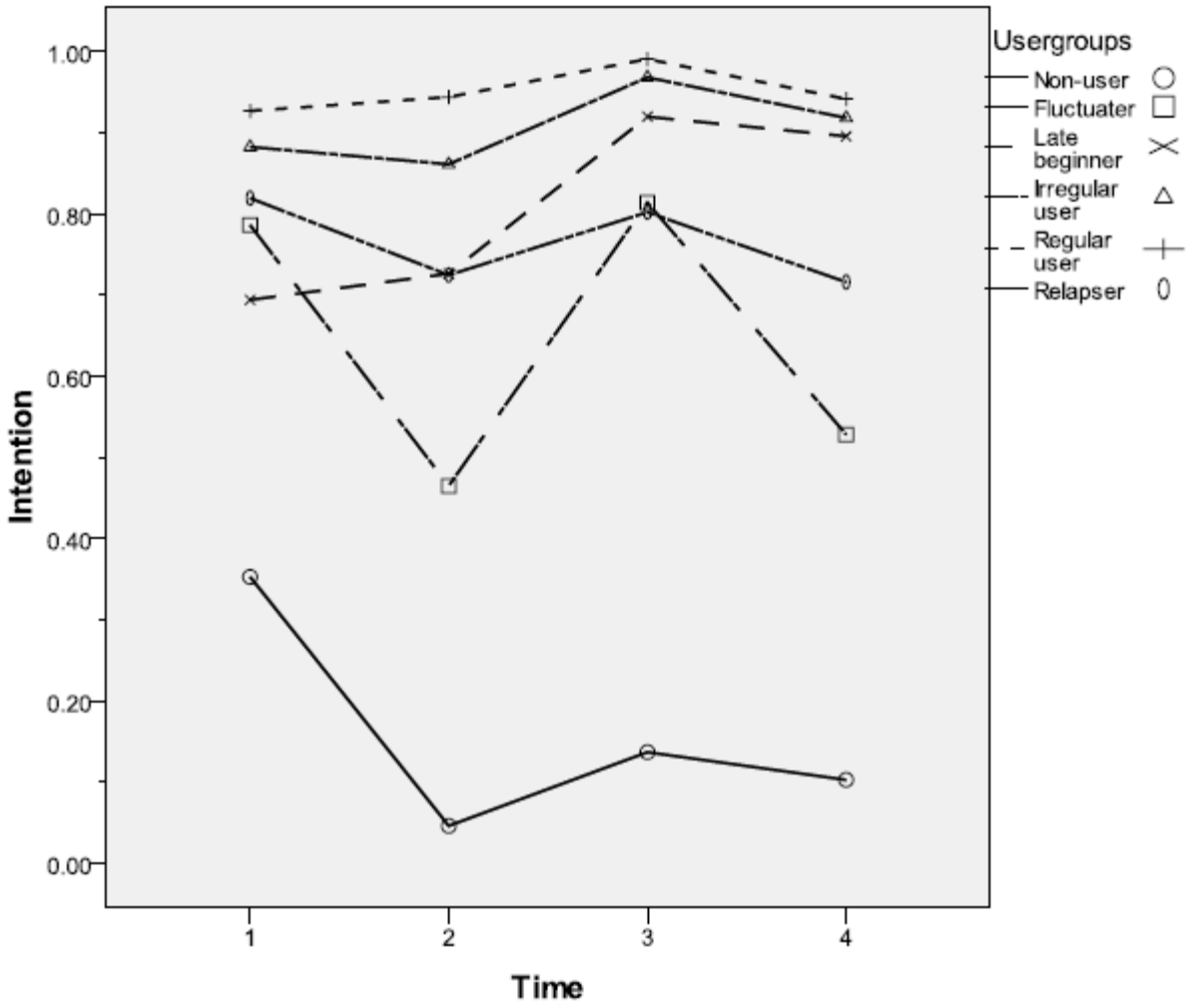
From this analysis, hypotheses IIa was supported; that is, fluctuaters show a lower attitude towards SODIS than irregular users.

For intention to use SODIS in the future, the change over time is significant ($F = 20.27$, $p < .001$, $df = 2.75$), as is the change due to groups ($F = 96.22$, $p < .001$, $df = 5$) and the interaction effect time*group ($F = 6.98$, $p < .001$, $df = 2$). Pair-wise comparisons of groups show that the change in intention is significantly different for most of the groups ($p < .019$)

[1] Attitude is presented from 1 = very positively/good to 0 = neither positively/good nor negatively/bad (attitude did not display negative values; therefore, 0 to -1 is not displayed). Time is delineated from 1 = Panel 1 to 4 = Panel 4.

except for the regular and irregular users, irregular users and late beginners, and the late beginners and relapsers. Figure 3 shows that regular users and irregular users have a constant high intention (with irregular users being a little lower than regular users); late beginners start with a lower intention than relapsers, but their intention increases to almost the same as irregular users; relapsers start a bit lower than irregular users and their intention decreases with time; fluctuaters vary in their intention between high and low, and non-users have a constant low intention.

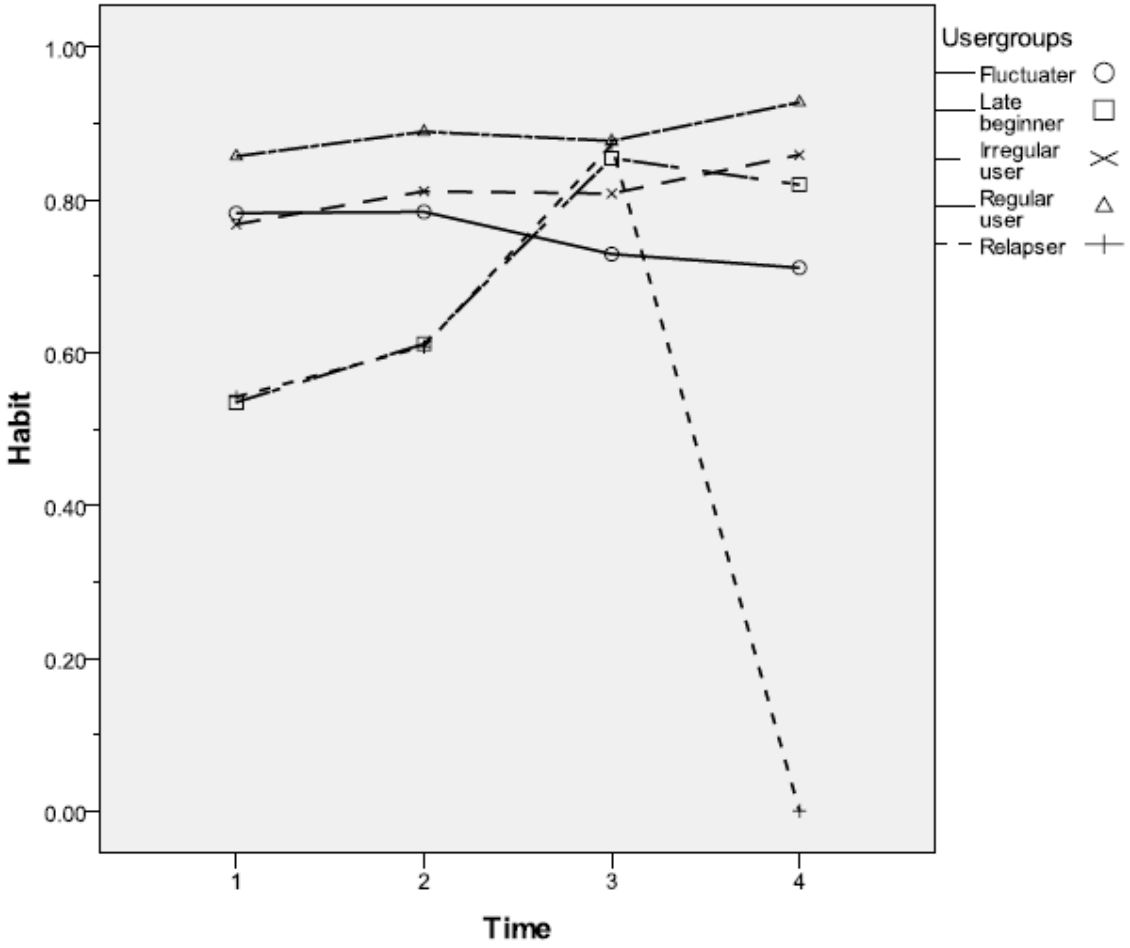
Figure 16: [Figure 3 in Study 3] Illustration of intention to use SODIS for user groups over time. [1]



[1] Intention is presented from 1 = very probable to 0 = not probable. Time is delineated from 1 = Panel 1 to 4 = Panel 4.

For the factor of habit, the change over time is significant (F = 30.44, $p < .001$, $df = 2.56$), as is the change due to group (F = 103.89, $p < .001$, $df = 4$) and the interaction effect time*group (F = 36.17, $p < .001$, $df = 10.26$). Pair-wise comparisons of groups reveal that all the groups differ significantly ($p < .003$) except for late beginners compared with fluctuaters. Figure 4 shows that regular users exhibit a constant high habit that slightly increases with time. The same is true for irregular users, but at a lower level. Fluctuaters have a lower level of habit than irregular users, which decreases with time. Late beginners and relapsers start at the same low level and both increase over time until T3, at which point the late beginners stay high and the relapsers show a strong decrease in habit.

Figure 17: [Figure 4 in Study 3] Illustration of habit of using SODIS for user groups over time. [1]



[1] Habit is presented from 1 = strong habit to 0 = no habit. Time is delineated from 1 = Panel 1 to 4 = Panel 4.

The findings on habit support hypotheses IIIa, IVa and Va; that is, irregular users exhibit a lower habit than regular users, regular users have the strongest habit of all the user groups and relapsers have a lower habit than irregular users.

Hypothesis Ib was not fully supported. Non-users do not have a similar attitude and intention to fluctuaters. However, fluctuaters only have a slightly higher attitude and intention than non-users, which is still lower than the other groups. Hypothesis IIb was also not fully supported, since the need of fluctuaters is not as high as that of irregular users; on the other hand, the attitude and intention of fluctuaters is in fact lower than those of irregular users, and the intention of fluctuaters does fluctuate. Hypothesis IIIb was partly supported, as irregular users do exhibit a lower need and a lower habit than regular users. However, they do not have a significantly lower attitude and intention than regular users. Hypothesis IVb was also partly supported: regular users have a higher need and higher habit than all the other groups. However, their attitude is similar to that of irregular users and late beginners, and their intention is similar to the intention of irregular users. Similarly, hypothesis Vb was partly supported: relapsers do have a lower intention and habit than irregular users. Their need is not similar to the need of irregular users. Instead, relapsers have a similar need to fluctuaters and late beginners.

Discussion

Interpretation of Results

The user groups that were hypothesised in TTM theory and found in previous research have also been identified with the data at hand. In the SODIS usage process, as with other health behaviours, people pass through stages. Some people are not using SODIS, while some cannot fully decide between use and non-use (fluctuaters) or use it irregularly. Some people fall back into their old (possibly unhealthier) behaviour and thus experience relapse. These

groups fit the stages of TTM: precontemplation (non-users), contemplation (fluctuaters), action (irregular users), maintenance (regular users) and relapse (relapsers). In addition to these groups from TTM, another group emerged that we did not initially hypothesise: the late beginners. In fact, the late beginners can be seen as irregular or regular users, only they adopt the behaviour later than the other users. However, as it is, they do not fit the criteria they need to belong to these groups (i.e., being a regular or irregular user at all four points of time examined). Therefore, and because they comprise a big enough group not to be left out, the late beginners were treated and analyzed as an additional group.

Once the user groups were identified, we analysed the development of attributes that define their stages in the adoption process according to the TTM. It was found that the main hypotheses could be corroborated and the others could be partly supported. In addition, the distinguishing factors for each stage could be identified: regular and irregular users are mainly differentiated by need and habit. This finding is in line with the results about the habit of high value continuers of SODIS (Tamas & Mosler, submitted). Accordingly, irregular users simply need to develop a higher habit to reach the maintenance stage. Irregular users and fluctuaters can be discerned by need, attitude, intention and habit. Thus, for a fluctuater to move up to the action stage, it might take more than one factor to be addressed. In this respect, late beginners seem to be a link between fluctuaters and irregular users, as late beginners are similar to both groups in regard to certain factors and often lay between these two groups in range of the factors. The main difference between fluctuaters and late beginners is intention, which has to be higher in order for fluctuaters to move into the stage of the late beginners and, beyond that, into the action stage. The non-users exhibit the lowest values of all the groups in all the factors. To begin their behaviour change process, they first need to develop a certain need so that they can move out of the precontemplation stage, which is characterized by a closed mindset. Relapsers have a similar or

even a little higher need, intention and attitude as fluctuaters and late beginners, but exhibit the lowest habit of all the groups. This supports earlier findings about relapsers' attributes in the behaviour change process, in which relapsers exhibit lower values in several factors in comparison to the SODIS continuers (Tamas & Mosler, submitted). Since habit is also the factor differentiating between regular and irregular users, it is important for irregular users to develop a stronger habit not only so that they can move into the maintenance stage, but also so they do not experience relapse.

Apart from the main differences between the stages of the behaviour change process, some more findings should be noted. First, non-users are very different from the other groups in regard to all factors and exhibit the lowest values in all the factors. Fluctuaters do not have a need as high as that of irregular users, but it is similar to that of late beginners and relapsers. It can be concluded that the groups that are less strong or advanced in the change process have not yet developed a high enough need, although their need is already higher than the need of the lowest group (non-users). This indicates that, even though groups like the fluctuaters, late beginners or relapsers should have moved beyond the stage in which need is the most important factor, need still plays a role.

On the other hand, irregular users do not differ in attitude and intention from regular users, as was hypothesized. Instead, they have a lower need and a lower habit. It seems that need is a factor that is important in more than one stage of the change process, but attitude and intention do not play a strong role in the maintenance stage. In addition, relapsers differ from irregular users in need, and they also have a lower intention and habit than the irregular users. It can be concluded that need should be addressed in all stages and a strong awareness of the issue should be built up.

The four examined variables show significant changes over time. The need for water treatment decreases slightly for most groups, with irregular users and late beginners only showing a tendency to differ in need, and relapsers, fluctuaters and late beginners showing no difference at all. Highest in perceived need are the regular users, followed by irregular users, relapsers, late beginners, fluctuaters and non-users. Attitude first rises, then decreases and increases again for all groups. Regular users, irregular users and late beginners are not different from each other in terms of attitude, and neither are late beginners, fluctuaters and relapsers. The order of the positivity of attitude follows regular users, irregular users, late beginners, relapsers, fluctuaters and non-users. Intention develops differently for the different groups. No differences are shown between regular and irregular users, irregular users and late beginners, and late beginners and relapsers. The order of strength of intention is regular users, irregular users, late beginners, relapsers, fluctuaters and non-users. In terms of intention, regular users and irregular users are constantly high, and late beginners increase to almost the same as irregular users. Relapsers decrease with time; fluctuaters vary between high and low, and non-users have a constant low intention. Habit increases with time, except for in relapsers and fluctuaters. All groups are different from each other except for the late beginners and fluctuaters. The order of habit strength is regular users, irregular users, fluctuaters, late beginners (who increase in habit to the point of regular and irregular users) and relapsers (who first increase in habit and then decrease). Since non-users cannot develop any habit, this variable did not apply to them.

Strength and Weaknesses of the Study

The study at hand is a field study and was implemented with the help of personal interviews in households of a developing country. As a result, the reliability of the items might not be as high as if the study were performed in a laboratory. On the one hand, it is not clear

whether all the questions are fully understandable and understood in the way they are meant. On the other hand, some of the factors we used are just one-item variables. The questionnaire should be designed to provide more than one item for each variable. The variables that do consist of more than one item show acceptable alpha values, but these can be also improved by ensuring their comprehensibility and providing enough suitable items for the targeted variable.

Another shortcoming of this study is that the variation over time of the attitude factor is not clear; at the third time-point, attitude shows a strong decrease for all groups without any obvious reason. For all we know, there were no mistakes in the coding of the question, and we are not aware of any external reasons that could have been responsible for this trend. However, since the order of the groups is still in line with TTM, we do not think this impairs the validity of the statements that were made.

The main achievement of this paper is showing that the behaviour change of SODIS follows the same process as other health behaviours. The findings of this study are strongly in line with prior findings of TTM research (e.g., Prochaska & DiClemente, 1982; Prochaska & DiClemente, 1983). Beyond finding the same groups that undergo the process in the same order as in earlier research, this paper examined factors that can be used to distinguish between the user groups. These factors can be very helpful for understanding the behaviour change process and for helping people move through this process into a maintenance stage, in which the new and healthier behaviour is regularly and habitually performed. To know which factors need to be tackled for people to move from one stage to the next in the health behaviour change process has practical implications for campaigns promoting healthy behaviour(s). Previous findings have already supported this conclusion of tailoring health interventions to the respective stage in the behaviour change process (Lippke & Ziegelmann, 2008; Mosler & Tobias, 2007; Schwarzer, 2008).

Implications for Practice

This study has identified factors that can be used to distinguish between user groups. Therefore, we now know which factors are responsible for the differences between user groups in different behaviour change stages. This knowledge shows us which factors can be tackled to move people from one stage to the next. This, in turn, tells us how campaigns can be shaped according to the stage(s) that the target group is in.

Non-users are in the precontemplation stage and therefore do not even think about changing their behaviour. Non-users differ from the other user groups most strongly in three factors: need, attitude and intention. Since non-users exhibit the lowest values of all the groups in all factors, these three factors that differentiate them from the other groups can be addressed. However, theoretically, it makes sense to first raise the need for water treatment so that non-users can come out of the precontemplation stage and see a necessity to start thinking about changing their behaviour. If someone views water treatment as fully unnecessary because he or she is unaware of waterborne diseases, it is very unlikely that person ever thinks about starting to treat water. Any campaign dealing with a large group of people who are in the precontemplation stage (either because the campaign is at a very early stage or people are resisting the campaign), the perceived need for the healthier behaviour should be increased. Need has also been shown to differ between other groups. Need seems to be an important factor that accompanies the whole change process, not only the beginning. Increasing need can be accomplished by informing the target group about the problems associated with the unhealthy behaviour. In the case of a SODIS campaign, people should be educated about bacterial contamination of water, waterborne diseases and possible ways to avoid them.

Fluctuaters, in the contemplative stage, are thinking about changing their behaviour and possibly trying it out. Fluctuaters and irregular users (in the next, the action stage)

are distinguished by need, attitude, intention and habit. Thus, for a fluctuater to move up to the action stage, more than one factor might need to be addressed. Late beginners seem to be a link between fluctuaters and irregular users. The main difference between fluctuaters and late beginners is intention, which has to be higher for fluctuaters to move into the late beginner stage and, after that, into the action stage. A campaign for SODIS could be directed toward fluctuaters by aiming to raise their intention. For example, persuasion can raise intention by improving attitude (Petty & Cacioppo, 1986b).

Irregular users are in the action stage and thus keep up the healthy behaviour, but not for as long or as regularly as people in the maintenance stage (regular users). Regular and irregular users are mainly differentiated by need and habit. Accordingly, irregular users must develop a higher need and a higher habit in order to reach the maintenance stage. Need can be increased by raising the knowledge about health issues. Prompts and public commitments are possible strategies to develop habit (DeYoung, 1993) and help irregular users move into the maintenance stage so that they are less likely to experience a relapse into non-use.

Relapsers have a similar or even a slightly higher need, intention and attitude than fluctuaters and late beginners, but exhibit the lowest habit of all the groups. Since habit is also the factor differentiating between regular and irregular users, it is important for irregular users to develop a stronger habit not only so they can move into the maintenance stage, but also so they do not experience relapse. Habit can be increased by using implementation intention contracts, which state where and when exactly the targeted behaviour will be implemented. This makes the integration of the behaviour into the daily routine easier and increases the commitment (Gollwitzer, 1999).

Conclusion and Outlook

SODIS use, like other health behaviours, follows a change process that is in line with the Transtheoretical Model of Change (Prochaska & DiClemente, 1982). The proposed stages were found, and the attributes of group members are in line with what was expected. Different psychological factors seem to have an influence in this process and are able to distinguish between the different user groups or stages. Lippke and Plotnikoff (2009) were also able to distinguish between the stages of TTM with factors from PMT in a study on physical activity. From the results at hand, conclusions were derived that a non-user has to develop a higher need (in this case, for water treatment) to move into the contemplation stage and become a fluctuater; fluctuaters, in turn, need to have a higher intention (to use SODIS) to become an irregular user (in the action stage). Irregular users are separated from the regular users (in the maintenance stage) by habit, which also separates them from the relapsers. Therefore, a stronger habit can help irregular users come to a stable SODIS use instead of relapsing to drinking raw water.

The identified psychological factors can help with the understanding of which stage of the behaviour change process someone is in, as well as which factor has to be addressed to move that person up to the next stage. Thus, the study at hand helped identify clues that shape successful behaviour change campaigns.

Overall Discussion

Interpretation of Results

Overall Results

From the results of the three studies presented here, we can deduce that SODIS use is established through such a behaviour change process that has been theoretically proposed in the I-Change Model. The results from all our studies fit the proposed factors soundly in each stage of the I-Change Model; additionally, factors which are proposed to be influential in one stage fit better for the explanation of the proposed stage than for the explanation of later stages. Overall, the model can provide additional insight into the explanation of the findings.

In study 1 we could show that the factors from the first stage, the awareness stage, can explain the intention and the adoption decision, but not the resulting action of how much SODIS is being used. Factors that we examined were: Knowledge, affect, attitude, perceived benefit, involvement, habit, conviction money, conviction time, conviction health, ability, self-persuasion and social influence. I will explain in detail, which factors have what kind of influence on their respective dependent variables, under "study 1".

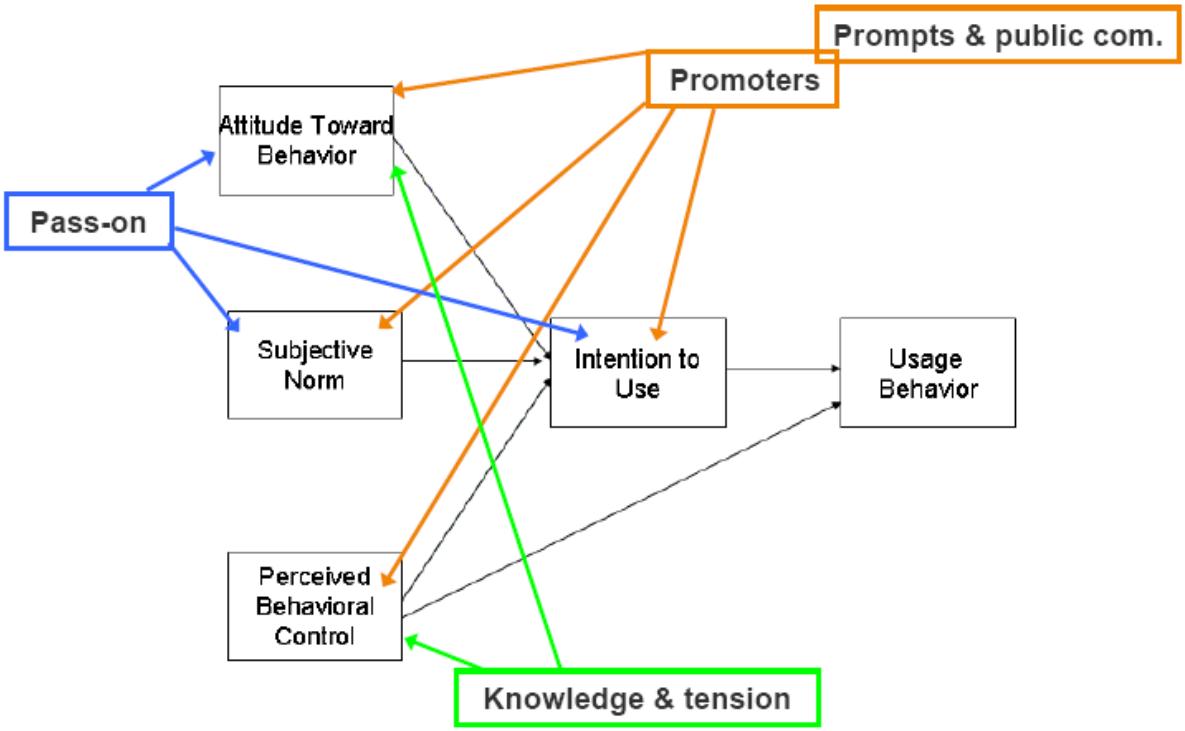
Another interesting fact is that the intention is explained by different awareness stage factors depending on the examination of either the intention of a user or a non-user. Information factors (message, channel, source, or how it is implemented here: attitude, affect, ability, social influence) are influential in both cases, as are certain cues to action (convictions, self-persuasion). The other awareness factors (knowledge and risk perception) are more important for the non-users to form an intention. Thus, for a non-user, being someone who is by definition just at the beginning of the behaviour change process, all the proposed awareness stage

factors play a role. The intention of users on the other hand, can not be explained by as many factors. A pattern seems to emerge: less factors from the first stage seem to be influential, the further on the right (i.e. the later) a dependent variable is placed in the process-chain of behaviour change. Many factors from the awareness stage influence the intention, which is the motivation stage of the model, but less so for users than for non-users. Even less factors can be used to explain the decision to adopt SODIS. Almost no variance can be explained with the factors from the awareness stage for the amount of SODIS used, which is in the action stage.

In study 2 we found, that those interventions, which were most successful in terms of behaviour change, always influenced all the behaviour change factors proposed in the motivation stage of the I-Change Model. At the first time point of measurement, promoters worked better in changing behaviour compared to the pass-on-task. This being a result of the promoters influencing all the factors of the motivation stage (attitude, social influence, efficacy), including the overall intention (or motivation). The pass-on-task on the other hand works with intention, social influence and attitude, but not through self-efficacy, meaning, pass-on-task do seem to influence the first named factors, but not the latter and thus have an influence on behaviour with the help of these first factors. At the second time point, again, the most influential interventions (prompts and public commitment) worked through all factors (attitude, social influence, efficacy and intention). The "knowledge and tension strategy" worked through self-efficacy and attitude, but not so much through intention and social influence, whereas the pass-on-task works through intention, attitude and social influence, but again lacks the influence on self-efficacy. Since the "knowledge and tension strategy" was more successful than the pass-on-task, it can be assumed that self-efficacy plays a bigger role than social influence and intention, or, put differently, that the lack of influence on self-efficacy impairs the effect of the intervention more strongly than the lack of influence on social factors and intention.

Please see figure 18 for a visualization, which of the behaviour change factors from study 2 are influenced by which interventions. In this graphic image it is also easy to assess which factors are in turn not influenced by which interventions.

Figure 18: Visualization of the effects of different interventions on behaviour change factors



The results of study 3 depict that the additionally proposed stage (or group of people) within the action stage of the I-Change Model, preparation, can be described as one distinct user group, complementing the user groups as proposed by TTM. However, relapse, which is assumed by TTM but not the I-Change Model, can also be found and should thus be integrated into the I-Change Model. From the four factors that were used to examine the differences between those user groups, need is the factor that helps to distinguish between most of the stages best. Attitude and intention mainly differentiate between the early stages precontemplation, contemplation and preparation. Habit differentiates between the later stages

preparation, trial (action), maintenance and relapse. Preparation seems to be a transitional stage, since it is distinguished from the earlier stages by intention and the later stages by habit.

In the following, the results for each study will be listed and explained in more detail.

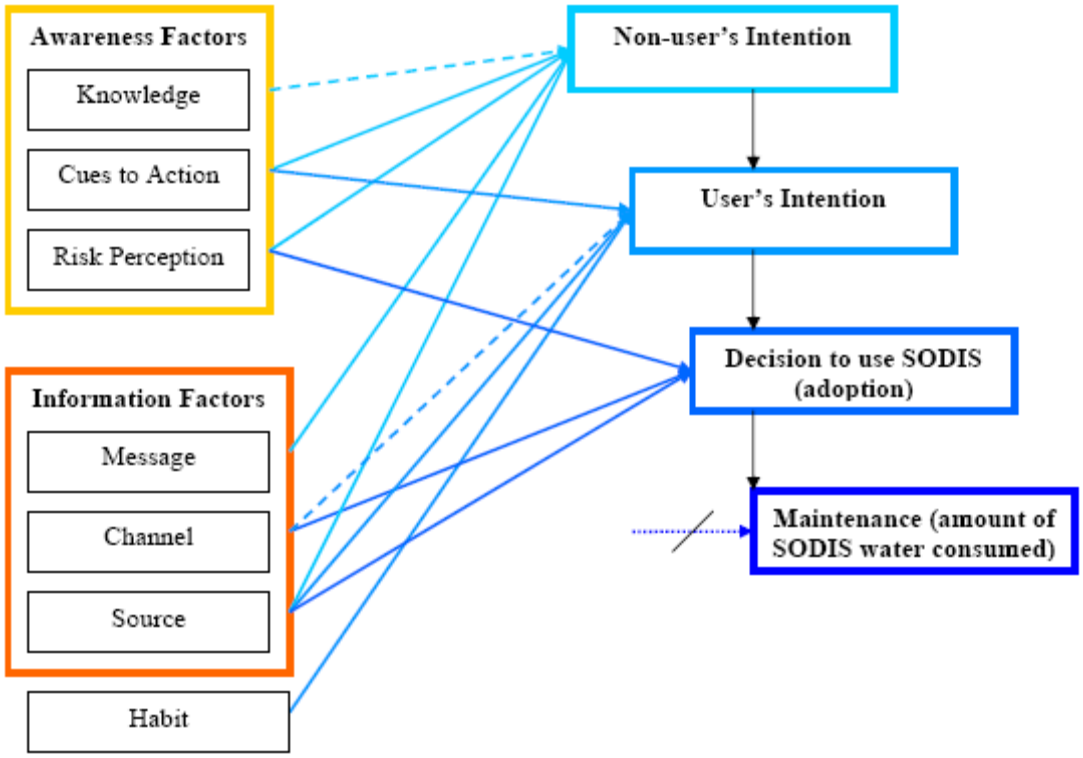
Study 1

The intention to use SODIS is influenced by different factors for either those who use SODIS (= users) and those who do not (= non-users). The users' intention is predicted by their habit strength, their conviction about health, their social influence, and – as a tendency – by their affect and attitude about SODIS as well as by self-persuasion. For non-users, the intention to use SODIS is predicted by attitude, involvement, conviction health and ability and – as a statistical tendency – by knowledge. This means, the second stage of the I-Change Model, the motivation stage, which is comparable to the concept of intention in the Theory of Planned Behaviour (TPB; Ajzen, 1985), can be predicted by those variables from the awareness stage. For users to develop a high intention and thus step over to the next stage, information factors (social influence and by trend attitude and affect) and cues to action (conviction and by trend self-persuasion) seem to be the most influential factors, as well as the additional factor habit. For non-users, some information factors are also important (attitude, conviction, ability), but also the awareness factors knowledge (by trend), risk perception (involvement) and cues to action (conviction) play an essential role. It seems that people who already started using SODIS are more affected by information factors and certain cues to action in comparison to non-users, who are more affected by awareness factors together with information factors. However, the information factor perceived benefit does not show any influence on intention for neither the users nor the non-users.

Some factors from the awareness stage can explain a lot of variance regarding some-one's decision to use SODIS or not (adoption), but these include only a few of the proposed variables from the study. In total two information factors (ability and social influence) plus one awareness factor (involvement or risk perception) are essential in the formation of an individual's decision. This means that not all of the proposed factors from the awareness stage of the I-Change Model influence the adoption of SODIS but that there is instead a selection of factors that do have a high impact. The decision to use SODIS should be formed in the second stage of the I-Change Model, where the intention (motivation) for the behaviour is developing. However, the decision seems to be one step further, time-wise, than the intention, since less of the awareness stage factors play a role for the decision than they do for the intention to form.

Nevertheless the amount of SODIS water consumed can not be explained by awareness or information factors. The factors from the first stage of the behaviour change process as proposed by the I-Change Model can not explain the use of SODIS. Considering the Model, the use of SODIS is theoretically located in the action stage. This, in turn, hints to the conclusion that the first stage factors can not reach that far. Rather, the factors from the awareness stage can explain intention and the terms under which someone decides to start using SODIS (adoption). These are both set in the second stage of the Model, where the motivation and decision to change behaviour is initially formed. Please see figure 19 for a visualization of the awareness and information factors and how they influence the intention and decision to use SODIS.

Figure 19: Results of study 1 visualized



Study 2

The conducted interventions of study 2 significantly influenced the number of SODIS users as well as how much water was being consumed. This they did to varying degrees depending on the respective type of intervention. Regarding these one has to conclude that the different interventions influenced different factors differently. It can be well assumed that behaviour changes are due to the factors which in turn are being changed by the interventions.

For time-point 1, promoters had a higher influence than the pass-on-task and the control on SODIS use. Promoters had a similar effect on intention to do SODIS and subjective norm as the pass-on-task; conviction about costs, conviction about taste, behavioural control and frequency of talking were better changed by the work of promoters. Conviction time, habit and tension about forgetting were changed in the same way by all three interventions. The pass-on-

task worked better than the promoter-strategy for improving subjective norm and knowledge. Thus, the strongest influence on behaviour can be reached through promoters, assisted by the factors intention, subjective norm, convictions, behavioural control and frequency of talking. Viewed under the framework of the I-Change Model, this signifies that the overall motivation factor (intention), but also its factors attitude, social influence and efficacy are having a strong impact on behaviour change. The pass-on-task affects behaviour through intention, social influence (subjective norm) and attitude (knowledge). The pass-on-task acts through the overall motivation and its two components: social influence and attitude, but it does not act through the factor efficacy. That might explain why the pass-on-task is less successful than the work of promoters.

For time-point 2, prompts and public commitment had a stronger effect than the "knowledge and tension strategy", which in turn worked better than the pass-on-task, which was only little better regarding some factors compared to the control condition. Prompts and public commitment had a very similar effect on the examined factors. They worked best for increasing subjective norm, conviction taste, knowledge and frequency of talking. They kept intention, behavioural control, conviction about costs, conviction about time and habit on a constant positive level. The "knowledge and tension strategy" worked best for improving behavioural control and equally well for increasing knowledge like prompts or public commitment did. The pass-on-task worked better than the control condition for intention, conviction about cost and frequency of talking.

When looking at the factors from the I-Change Model again, we can see that prompts and public commitment both work through social influence (subjective norm, frequency of talking), attitude (convictions, knowledge), efficacy (behavioural control and habit on constant level) and intention. The "knowledge and tension strategy" works mainly through efficacy

(behavioural control) and attitude (knowledge). It does not work best for social influence and the overall intention, which could explain why it is less successful than prompts and public commitment. The pass-on-task works best through intention, attitude (conviction about cost) and social influence (frequency of talking). It does not work through efficacy at this point of time. Since the less successful pass-on-task does influence the intention, but knowledge and tension does not, it is not clear whether intention is actually an extra factor as was suggested by us. It may be that the I-Change Model is right in proposing that the three factors attitude, social influence and efficacy together are representing the factor intention sufficiently.

Overall, we can see that the most successful intervention strategies work with all factors which are proposed for the motivation stage of the I-Change Model. The less successful strategies miss one or more of those factors. The role of intention is not completely explained yet; the question remains whether it is an additional factor or whether it is represented sufficiently by its four parts attitude, social influence and efficacy.

Study 3

There is one main difference between the stages within the action stage as described in the I-Change Model and the stages as described by the Transtheoretical Model of Change (TTM). Regarding the stages, in the TTM precontemplation, contemplation, action, maintenance and relapse are assumed, while in the I-Change Model the stages precontemplation, contemplation, preparation, trial and maintenance are proposed. Thus, preparation is a factor only assumed by the I-Change Model, while trial is in line with action and while relapse is only mentioned in TTM. When we were looking for user groups within our sample, we were able to identify the stages, that is, to determine the stages that were actually present.

The user groups which were identifiable were: precontemplation (non-users), contemplation (fluctuaters), action (or trial; irregular users), maintenance (regular users) and relapse (relapsers). These are the stages as proposed by TTM. However, we were able to identify one more group: the late beginners. This group clearly emerged as an independent group, which is in between the contemplation and the action stage: They are irregular users, but do not fit the criteria of this group, since they adopt the behaviour later than the others, but they do not fall back into non-use, like the other members of the contemplation group, so they do not belong to that group either. The I-Change Model assumes one more stage to exist between the contemplation and the action (trial) stage and that is the preparation stage. Thus, our results point out that the proposed stages of the I-Change Model are more adequate, including the preparation stage, it being the main difference to TTM. However, the relapse stage, which is assumed in TTM, but not in the I-Change Model, could be found as well. Thus, the I-Change Model should be completed by the possibility of relapse as well.

In addition to identifying the stages of action, distinguishing factors for each stage could be identified: regular (maintenance) and irregular users (trial) were mainly differentiated by need and habit; irregular users (trial) and late beginners (preparation) were distinguishable by habit, which developed later in late beginners than in irregular users, and as a tendency by need; the main difference between late beginners (preparation) and fluctuaters (contemplation) was intention; non-users (precontemplation) exhibited the lowest values of all the groups in all the factors. Relapsers had a similar or even a little higher need, intention and attitude compared to fluctuaters (contemplation) and late beginners (preparation), but exhibited overall the lowest habit of all groups.

It can be seen that need is a factor which is being important in more than one stage of the action change process, whereas main differences between trial, maintenance and relapse

stages can be attributed to (lack of) habit. Intention and attitude played a stronger role for differentiating between the early stages of precontemplation and contemplation. Preparation seems to be a transitional stage, because it differentiates from the contemplation stage by intention and from the trial stage by habit. Overall, these findings are in line with what one would expect, given that the factors need, attitude, intention and habit are derived from the attributes ascribed to the stages within the action stage.

Research Questions

Several research questions were identified in the introduction, which will be answered in the following.

Study 1

Is persuasion present in the awareness stage of the I-Change Model? The results could show that the persuasion variables could be matched with the awareness factors and the information factors of the awareness stage of the I-Change Model. Several factors of the awareness stage could predict the intention and the decision to use SODIS. The intention represents the motivational stage, but one could also deduct that the intention state (derived from intention and decision to use SODIS) is influenced by the awareness factors and that the I-Change should accordingly be complemented by more arrows which show this influence. Information factors and certain action cues were influencing the intention of both the users and the non-users, while only the non-users' intention was influenced by all the factors as proposed in the awareness stage. The decision to use SODIS was influenced strongly, but only by a few of the proposed awareness factors: The information factors ability and social influence and the awareness factor risk perception. It seems that the further on the right (i.e. the later) a dependent variable is set in the behaviour change process (it is assumed that the decision happens after the

formation of intention and that the users' intention is formed later than the non-users' intention), the less factors of the awareness stage play a role. Please see figure 19 for an overview of the awareness and information factors and how they influence the intention and the decision to use SODIS.

Does persuasion also occur in other stages? The amount of SODIS consumed, which can be considered to be part of the behaviour stage, could only be explained to a very small percentage by the awareness factors. Thus, the second stage as proposed by the I-Change Model, the motivation stage can be explained well by the awareness factors, but the third stage, the action stage, can not. But still the third stage should be influenced by the second stage in turn, which would fit the logic of a behaviour change process as suggested in the I-Change Model: change happens in consecutive stages.

Study 2:

How do the interventions influence factors of the TPB and additional factors, as they are assumed in the I-Change Model and which factors are changed? Each intervention influences different factors, depending on their type. It could be shown that the more successful interventions change more factors than the less successful ones. Promoters, prompts and public commitment influence all four I-Change factors from the motivation stage: intention[1], attitude, social influence and efficacy. The "knowledge and tension strategy" did not influence social influence and intention. The pass-on-task did not influence efficacy (on neither of the two time-points). Since the pass-on-task is the least successful of all the intervention strategies,

[1] Intention is not seen as a factor of the motivational stage in the I-Change, but if the theoretical base of the I-Change is looked at, it becomes clear that the motivational stage acts as a replacement of the intention as it is seen in the TPB; therefore, we re-included intention as part of the motivational stage.

addressing efficacy seems to be an essential part of a successful SODIS behaviour change process.

How do these factors change with time and under the influence of interventions? At the first point in time that is being looked at, the interventions increase all the factors. The only exception is habit (efficacy), which decreased for pass-on-task and control condition. So the pass-on-task did not succeed in creating a habit for users; instead, hindering factors like forgetting could not be prevented by the pass-on-task and thus, habit decreases. Other decreasing of factors was only taking place in the control condition, for the factors intention (motivation) and subjective norm (social influence). It seems that the lack of activity and planned campaign had a negative effect in particular on the intention and the subjective norm. Maybe people felt kind of abandoned (only interviewers were coming, but no-one to promote SODIS or teach it to them, like they might have seen or heard in other places). This could lead to a negative effect similar to defiance. “If they do not care for me, I do not want to do SODIS in the future”. If this kind of thinking was the case, it could also explain the decrease in subjective norm: people perceive others to think similarly negative.

At the second point in time which is examined, more factors are decreasing than has been the case for the first time point. Partly, this is explicable by a ceiling effect: many factors were already so high that they were more likely to decrease than to increase further. Intention (motivation) and behavioural control (efficacy) decreased in the pass-on and control conditions, conviction about costs (attitude) decreased in the control condition, habit (routine efficacy) decreased in the pass-on-task area, frequency of talking (social influence) decreased in the pass-on and control conditions and knowledge (attitude) as well as tension (efficacy) decreased in the pass-on-area. At T1, mainly efficacy and social influence were not positively developing in all areas. The least successful areas, where the pass-on-task had taken place and the

control condition, were also the less successful areas in terms of number of users and amount of SODIS consumed. Only for the control condition, this was the expected effect. No structured intervention had taken place, so no "success" in terms of users or positive factors was expected. Thus the pass-on-task seems to not be sufficient for keeping behaviour change factors high. The level of activity might need to be higher for people to perceive a more positive social influence and to feel more able to implement SODIS (efficacy). At T2, efficacy, attitude and social influence were partly decreasing; the pass-on-task was not successful in increasing these factors. Neither did the control condition increase them. Like the first research question to study 2, this also shows that the more successful interventions were able to influence all relevant factors from the I-Change Model positively.

Study 3:

Are the stages as assumed by the TTM or by the I-Change Model identifiable amongst SODIS users? The stages as they are assumed by TTM (precontemplation, contemplation, action, maintenance, relapse) can be found in the form of user groups amongst the examined sample. However, one additional stage can also be found that matches the preparation stage as suggested by the I-Change Model. Thus, both models need to be supplemented by adding one more stage each: The TTM could be complemented by the preparation stage or the I-Change Model could be complemented by the relapse stage.

Which factors differentiate between the identified stages? Four factors have been deduced from the attributes of the stages: Need, attitude, intention and habit. Need was found to be important in all stages. Attitude and intention differentiate between precontemplation, contemplation and preparation. Habit distinguishes between preparation, trial, maintenance and relapse. Preparation can thus be seen as a transitional stage between the early and the late stages

of the action stage within the I-Change Model. That means, preparation could be viewed as a stage between the intention stage (in that case consisting of precontemplation and contemplation) and the behaviour stage (consisting of trial and maintenance).

Strength and Weaknesses

Regarding this thesis the relevant factors in each of the three studies might not always fit the factors of the I-Change Model perfectly. Some factors just have a slightly different label, but are essentially the same thing (e.g. convictions as they are operationalized in the studies at hand relate well to the concept of pros and cons from the I-Change Model). For others, however, it is not fully clear whether the factor as it is proposed here perfectly matches what the authors of the I-Change Model intended with the corresponding factor (like self-persuasion being used as a cue to action). This is partly due to a lack of in-depth, detailed explanation of the used factors in the I-Change Model. The authors seem to have assumed that some factors are understandable because they are being used in literature already, like the information factors message, channel and source. Nonetheless, for future researchers of the I-Change Model, it would be helpful if a clearer picture about the implementation of these factors could be drawn. Otherwise, as was the case in the thesis at hand, future authors are forced to find their own items for these rather broadly listed factors. The same is true for factors which have not been included in the research at hand: predisposing factors, ability factors and barriers.

Nevertheless, this thesis has succeeded in analyzing and discussing results and findings in the light of the I-Change Model. As such, it is to the knowledge of the author of this thesis the only work offering such an extensive overview over the I-Change Model. All three proposed stages have been looked at and a meaningful integration of the stages and their factors

has been accomplished. This should provide a helpful ladder for future research to climb higher in the understanding of the behaviour change process as proposed in the I-Change Model.

Implications for Practice

For any successful campaign to disseminate SODIS, it is important to know which factors change SODIS behaviour or water treatment behaviour in general. It is also important to know whether different factors are differently influential depending on which stage someone is in or whether such stages exist at all. With the thesis at hand, it could be shown that SODIS behaviour changes within the course of a process like the one mapped by the I-Change Model. Thus, once the stage the target group is in; or the stages that different parts of the target group are in, are identified, the respective factors from those stages can be influenced within a campaign. By using the factors that fit the stage, and most important, by using all the factors of one stage, an intervention or campaign is most likely to be successfully creating behaviour change towards SODIS use. The following questions are guiding through the behaviour change process under the light of the insights presented here and identify issues that should be considered when planning a campaign.

Why do people start using SODIS? Awareness and information factors from the first stage of the I-Change Model play a big role for people to form the intention to use SODIS. Particularly at the beginning of any campaign, these factors should be considered. People who do not use SODIS should receive the necessary knowledge about SODIS and its background, they should be made aware of their risk of getting sick with waterborne diseases and they should receive cues to action like persuasive arguments about the attributes of SODIS. This should happen with some kind of message and through those channels and sources that stand for a high social status, that are understandable and that arouse a positive affect and attitude. To accomplish

this, a message should use a language that is easy to understand, it should be well explained and it should list the advantages of the behaviour change or targeted technology. Listing some disadvantages helps the receiver of a message to deliberate and take a free and strong decision. Sources that have a high social status could for instance be some respected and well-known members of the community or else, celebrities. Dependent on the social environment, a credible and liked channel can be to hear something in TV or the church.

How can the decision to use SODIS be influenced best? For people to make the decision to use SODIS, after they have developed the intention to use it, it is most important that the message is understandable; that social influence is positive; and that they are aware of their risk of contracting waterborne diseases. For the message to be understandable it is important to train those people who deliver the message thoroughly. If promoters are employed, they should receive a training that enables them to answer all sorts of questions about waterborne diseases, water treatment and SODIS. Positive social influence can also be evoked through the source of a message; if promoters are employed, they should have a high social status. Risk perception can be influenced by informing well about the causes of waterborne diseases and the relation to water treatment.

Which interventions create behaviour change most successfully and why? Promoters had the most beneficial influence in the research at hand. Prompts and public commitment worked well in keeping up SODIS behaviour, but it is questionable whether they could produce behaviour if they are implemented without prior persuasive and informative campaigning. Other examined interventions like the pass-on-task or the "knowledge and tension strategy" have not been as successful as promoter work. Promoters are influencing all four factors from the second stage of the I-Change Model: intention, attitude, social influence and efficacy. The same is true for prompts and public commitment. The less successful strategies pass-on-task

and “knowledge and tension strategy” do not influence all factors. The pass-on-task is not able to influence efficacy, whereas the “knowledge and tension strategy” does not influence intention and social factors. Thus, it can be assumed that a successful intervention strategy should be able to influence all factors of the motivation stage of the I-Change Model.

How does the behaviour change process take place? The findings of the research at hand show that the behaviour change process of adopting SODIS takes place in three stages: an awareness stage, where people have to be informed and persuaded about the benefits of SODIS, a motivation stage, where the intention to use SODIS has to be formed with the help of attitude, social influence and efficacy, and an action stage, where the behaviour is initiated. This finding corresponds with other behaviour change theories like the Protection Motivation Theory (Rogers & Prentice-Dunn, 1997) or the elaborated Health Action Process Approach (Schwarzer, 2008). Roughly three stages can also be deducted from these models. Together with more stages, the three stages proposed here (awareness, intention and action) can also be found in other behaviour change or dissemination models (e.g. Precaution Adoption Process Model from Weinstein and Sandmann, 1992 or the Theory of Diffusion of Innovations from Rogers, 2005). It can be inferred that a campaign to disseminate SODIS use should accompany those stages with the appropriate interventions which address factors suitable to each stage.

Why do people stop using SODIS, that is, what do they need to keep on using it? Habit seems to be a crucial factor which makes the difference whether someone comes to maintain a regular SODIS behaviour or relapses into non-use. This result is in line with other current research (Tamas & Mosler, submitted). Habit can be developed with the help of memory aids like prompts and public commitments (DeYoung, 1993; Tobias, 2009). To be aware of the need for water treatment, in other words, risk perception, is another factor which accompanies the whole action process of implementing behaviour (Siegrist & Cvetkovich, 2002), in this case

SODIS behaviour. It seems like need is a necessary factor for behaviour change to take place at all.

Conclusion

It has been shown that the uptake of health behaviours follows a behaviour change process (e.g. Becker, 1974, De Vries & Mudde, 1998, Prochaska & DiClemente, 1983). The research at hand could show that SODIS adoption also follows such a process. These findings are in line with prior research about SODIS as a behaviour change process (Tamas, 2008, Tamas & Mosler, submitted). The research at hand could show in particular that the I-Change Model (De Vries, 2004) provides a suitable framework for understanding the SODIS adoption process. Understanding the stages of the process and the factors that are important within each stage offers a valuable support for planning future campaigns for SODIS and increases the likelihood for successful SODIS dissemination. We hope that the findings presented here do not only help to improve SODIS intervention planning, but planning for any health behaviour campaign.

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Attachment

QUESTIONNAIRE FOR PANEL 7 OF SODIS IN ZIMBABWE JANUARY 2008

For the interviewers: Please write down how many or **which** households (their **assigned household number**) did **not** want to be interviewed before you found this household who takes part in the interview.
.....

Please interview the person of the household that is responsible for the water for the family.

INTRODUCTION

Thank you very much for wanting to take part in this interview! You have already taken part a while ago and we would like to interview you again and would like to come back every two month if that is fine with you.

We are not interested in any particular answers, just in the answers that really represent your opinion. We do not want you to engage in any behavior in particular, we would like to know why people are doing what they are doing so that we can improve the drinking water situation depending on this information.

So it helps us most if you answer as honest and properly as possible. Please help us in finding out how things really are.

We would like to get as much information as possible and therefore some questions of the same topics will be similar - we are sorry if they seem to be repetitive.

QUESTIONS ABOUT THE HOUSEHOLD

Assigned household number: .....

Name of village and settlement / zone: .....

Address (Name of Street and house number):.....

Date of the interview:.....

Number and Name of Interviewer: .....

Name of the household head: .....

Name of person interviewed (responsible for water): .....

DEMOGRAFIC INFORMATION

0.1 Total number of people living in the household: .....

0.2 Number of children below five years of age: .....

0.3 How many long interviews about SODIS did you do before? .....

0.4 Did the number of people in the household change in the last four months?

0.4.1 If yes, why? .....

PART 1: DRINKING WATER

1.1 How much of which kind of water do you normally drink in one day? ***→ Indicate in cups per day. If the person does not know, take an example from today or yesterday.***

For the interviewer: how many milliliters (ml) do the cups approximately have? .....

Do you drink…	How many cups **per day**?	How many days in the last week?
• SODIS water		
• raw water / not treated (includes tap water if not treated)		
• boiled water, natural or like coffee / tea / soup		
• with chlorine treated water		
• with filter treated water		
• bought drinks like mineral water, soft drinks, juices, beer, etc.		
• other:……		

1.2 Where does most of your drinking water come from?

6 ❑ unprotected well (without a lid)
5 ❑ protected well (with a lid)
4 ❑ borehole
3 ❑ tab
2 ❑ rainwater
1 ❑ other (what: .....)

1.3 Do you see a need for water treatment?

5 ❑ Very much.
4 ❑ Much.
3 ❑ Quite much.
2 ❑ A little bit.
1 ❑ Not at all.

1.4 Do you think that drinking raw water makes you healthier or less healthy?

1 ❑ Much healthier.
2 ❑ Quite healthier.
3 ❑ Healthier.
4 ❑ A little bit healthier.
5 ❑ No change.
6 ❑ A little bit unhealthier.
7 ❑ Unhealthier.
8 ❑ Quite unhealthier.
9 ❑ Much unhealthier.

1.5 What do you think how safe your drinking water is right now?

1 ❑ Very safe.
2 ❑ Safe.
3 ❑ Quite Safe.
4 ❑ A little bit safe.
5 ❑ Not safe.

1.6 Are there any problems with the quality of your drinking water?

1 ❑ No Problems
2 ❑ Some problems, but not related to bacterial contamination, but related
3 to:.....
4 ❑ Problems about bacterial contamination, but no details.
5 ❑ Problems about bacterial contamination, knows details (how it happens and/or the health problems).
❑ Knows about contamination and the solutions (water treatment, hygiene).

1.7 How important is it for you that your drinking water is healthy?

5 ❑ Very important.
4 ❑ Important.
3 ❑ Quite important.
2 ❑ Not very important.
1 ❑ Not important.

1.8 How important is water treatment for you?

5 ❑ Very important.
4 ❑ Important.
3 ❑ Quite important.
2 ❑ Not very important.
1 ❑ Not important.

1.9 How serious is it, when you or your kids have diarrhea?

5 ❑ It is a very serious sickness.
4 ❑ It is a serious sickness.
3 ❑ It is quite serious.
2 ❑ It is a little bit serious.
1 ❑ It is normal.

1.10 How likely is it for you to get diarrhea?

5 ❑ Very likely.
4 ❑ Likely.
3 ❑ Quite likely.
2 ❑ Not very likely.
1 ❑ Not likely.

PART 2: CHECK ON SODIS

2.1 Have you ever heard about SODIS?

❑ Yes (1) ❑ No (0)

The following section only if person has heard about SODIS. → IF NOT heard about SODIS: JUMP to PART 4: INFORMATION ABOUT SODIS on Page 11!

2.2 From where did you hear about SODIS?	**2.3 How trustworthy is that source of information for you?**	**2.4 How convincing was what you were told about SODIS?**	**2.5 When did you hear about SODIS?**
❑ at an information event	5 ❑ Very trustworthy 4 ❑ Trustworthy 3 ❑ Quite trustworthy 2 ❑ A little bit trustworthy 1 ❑ Not trustworthy	5 ❑ Very convincing 4 ❑ Convincing 3 ❑ Quite convincing 2 ❑ A little bit convincing 1 ❑ Not convincing	5 ❑ one to seven days ago 4 ❑ two to three weeks ago 3 ❑ one to two month ago 2 ❑ three to four month ago 1 ❑ five to six month ago
❑ by a friend /neighbor	5 ❑ Very trustworthy 4 ❑ Trustworthy 3 ❑ Quite trustworthy 2 ❑ A little bit trustworthy 1 ❑ Not trustworthy	5 ❑ Very convincing 4 ❑ Convincing 3 ❑ Quite convincing 2 ❑ A little bit convincing 1 ❑ Not convincing	5 ❑ one to seven days ago 4 ❑ two to three weeks ago 3 ❑ one to two month ago 2 ❑ three to four month ago 1 ❑ five to six month ago
❑ from an interviewer	5 ❑ Very trustworthy 4 ❑ Trustworthy 3 ❑ Quite trustworthy 2 ❑ A little bit trustworthy 1 ❑ Not trustworthy	5 ❑ Very convincing 4 ❑ Convincing 3 ❑ Quite convincing 2 ❑ A little bit convincing 1 ❑ Not convincing	5 ❑ one to seven days ago 4 ❑ two to three weeks ago 3 ❑ one to two month ago 2 ❑ three to four month ago 1 ❑ five to six month ago

❑ from a SODIS promoter or health worker	5 ❑ Very trustworthy 4 ❑ Trustworthy 3 ❑ Quite trustworthy 2 ❑ A little bit trustworthy 1 ❑ Not trustworthy	5 ❑ Very convincing 4 ❑ Convincing 3 ❑ Quite convincing 2 ❑ A little bit convincing 1 ❑ Not convincing	5 ❑ one to seven days ago 4 ❑ two to three weeks ago 3 ❑ one to two month ago 2 ❑ three to four month ago 1 ❑ five to six month ago
❑ others:	5 ❑ Very trustworthy 4 ❑ Trustworthy 3 ❑ Quite trustworthy 2 ❑ A little bit trustworthy 1 ❑ Not trustworthy	5 ❑ Very convincing 4 ❑ Convincing 3 ❑ Quite convincing 2 ❑ A little bit convincing 1 ❑ Not convincing	5 ❑ one to seven days ago 4 ❑ two to three weeks ago 3 ❑ one to two month ago 2 ❑ three to four month ago 1 ❑ five to six month ago

2.6 What did that person(s) tell you? **(More than one answer possible)**

13 ❑ My drinking water is contaminated with bacteria/viruses, which can make me and my family
12 sick.
11 ❑ SODIS is a (solar) water disinfection/purification method.
10 ❑ With the sunlight and its UV-Radiation and the heat SODIS can make the water safe.
9 ❑ You have to use transparent PET plastic bottles up to three liters.
8 ❑ Do not use colored bottles, damaged bottles, heavily scratched bottles and PVC bottles.
7 ❑ You have to put the bottles in the sun.
6 ❑ Put the bottles in the sun for six hours, if it is really cloudy let them expose two days.
5 ❑ SODIS prevents diseases like diarrhea and cholera.
4 ❑ SODIS is very cheap.
3 ❑ SODIS is easy to handle and not effortful.
2 ❑ SODIS can save you money otherwise spent on medication.
1 ❑ SODIS tastes good.
❑ other: .....

2.7 Please answer some questions about the person(s) who told you about SODIS:

	Very much 5	Much 4	Quite much 3	A little 2	No 1
• Did that person know what he/she was talking about?					
• Are you looking up to that person?					
• Do you find that person pleasant?					
• Is that person similar to you in interest?					
• Do you like that person?					

• Is it important to you what that person says?					

2.8 Can you explain what SODIS is and how it works?

6 ❑ Knows all the important things about SODIS (which bottles, how long in the sun, kills bacteria).
5 ❑ Knows that it makes water drinkable and that it needs bottles and sun (but no further details about bacteria).
4 ❑ Knows that it needs sun to kill the bacteria (but does not know details about bottles)
3 ❑ Knows about the bottles (but no further details).
2 ❑ Could not explain what SODIS is and how it works.
1 ❑ other: .....

2.9 How often did you think about SODIS in the last week?

5 ❑ Very often.
4 ❑ Often.
3 ❑ Sometimes
2 ❑ Rarely.
1 ❑ Never.

2.10 How committed do you feel to do SODIS?

5 ❑ Very much.
4 ❑ Much.
3 ❑ Quite much.
2 ❑ A little bit.
1 ❑ Not at all.

2.11 Are you doing SODIS?

5 ❑ Is doing SODIS regularly.
4 ❑ Is doing SODIS sometimes.
3 ❑ Has tried SODIS for a while and stopped.
2 ❑ Has tried SODIS once and stopped.
1 ❑ Is not doing SODIS.

The following section only if person IS doing SODIS regularly or sometimes. → IF the person is NOT doing SODIS: JUMP to after this table, page 6.

2.11.1 If yes, how much do you agree to the following reasons to do SODIS (Why are you doing SODIS)?

	9 I agree very much	8 I agree	7 I quite agree	6 I agree a little	5 I neither agree nor disagree	4 I disagree a little	3 I quite disagree	2 I disagree	1 I do not agree at all 2
SODIS is understandable / a lot of info about SODIS attainable.	❑	❑	❑	❑	❑	❑	❑	❑	❑
The water is dirty/unsafe, it needs to be treated.	❑	❑	❑	❑	❑	❑	❑	❑	❑

Bottles are easily available.	❑	❑	❑	❑	❑	❑	❑	❑	❑
SODIS is cheap / safes money.	❑	❑	❑	❑	❑	❑	❑	❑	❑
SODIS is not time consuming.	❑	❑	❑	❑	❑	❑	❑	❑	❑
SODIS cleans the water and is a trustworthy method.	❑	❑	❑	❑	❑	❑	❑	❑	❑
I know no better treatment than SODIS.	❑	❑	❑	❑	❑	❑	❑	❑	❑
SODIS is a habit.	❑	❑	❑	❑	❑	❑	❑	❑	❑
The SODIS-water tastes good.	❑	❑	❑	❑	❑	❑	❑	❑	❑
I can treat enough water for the whole family with SODIS.	❑	❑	❑	❑	❑	❑	❑	❑	❑
SODIS is not effortful.	❑	❑	❑	❑	❑	❑	❑	❑	❑
I like to do it.	❑	❑	❑	❑	❑	❑	❑	❑	❑
The others do it, too.	❑	❑	❑	❑	❑	❑	❑	❑	❑
Someone told me that SODIS is a good method to treat water.	❑	❑	❑	❑	❑	❑	❑	❑	❑
other:	❑	❑	❑	❑	❑	❑	❑	❑	❑

The following section only if person is NOT doing SODIS or has stopped doing it. → IF the person is doing SODIS: JUMP to PART 3: QUESTIONS FOR THOSE WHO DO SODIS, page 7.

2.12.1 If no, how much do you agree to the following reasons not to do SODIS?

	1 I agree very much	2 I agree	3 I quite agree	4 I agree a little	5 I neither agree nor disagree	6 I disagree a little	7 I quite disagree	8 I disagree	9 I do not agree at all
SODIS is not understandable / no Info about SODIS attainable.	❑	❑	❑	❑	❑	❑	❑	❑	❑
The water is clean (enough), it does not need a treatment.	❑	❑	❑	❑	❑	❑	❑	❑	❑
It is difficult to get bottles or bottles are unavailable.	❑	❑	❑	❑	❑	❑	❑	❑	❑

SODIS is too expensive.	❑	❑	❑	❑	❑	❑	❑	❑	❑
SODIS is too time consuming.	❑	❑	❑	❑	❑	❑	❑	❑	❑
SODIS can not clean the water / the method can not be trusted.	❑	❑	❑	❑	❑	❑	❑	❑	❑
I am used to do a different or better treatment - Which?	❑	❑	❑	❑	❑	❑	❑	❑	❑
I am always forgetting to do it (SODIS is not a habit).	❑	❑	❑	❑	❑	❑	❑	❑	❑
The SODIS-water does not taste good.	❑	❑	❑	❑	❑	❑	❑	❑	❑
It is only a small amount treatable with SODIS.	❑	❑	❑	❑	❑	❑	❑	❑	❑
SODIS is too effortful.	❑	❑	❑	❑	❑	❑	❑	❑	❑
I do not like to do it.	❑	❑	❑	❑	❑	❑	❑	❑	❑
The others do not do it, either.	❑	❑	❑	❑	❑	❑	❑	❑	❑
Someone told me that SODIS is not a good method to treat water.	❑	❑	❑	❑	❑	❑	❑	❑	❑
other:	❑	❑	❑	❑	❑	❑	❑	❑	❑

The following section only if person is doing or has done SODIS. → IF the person has NEVER done SODIS: JUMP to PART 4: INFORMATION ABOUT SODIS on Page 11!

PART 3: QUESTIONS FOR THOSE WHO DO OR DID SODIS

3.1 BOTTLE OBSERVATION

3.1.1 Number of bottles in the sun (and warm): .....

3.1.2 The bottles and their lids are clean.

all ❑ ❑ ❑ ❑ ❑ none
5 4 3 2 1

3.1.3 The bottles contain less than 3 liters.

all ❑ ❑ ❑ ❑ ❑ none
5 4 3 2 1

3.1.4 The bottles are transparent and without label.

all ❑ ❑ ❑ ❑ ❑ none
5 4 3 2 1

3.1.5 The water in the bottles is clear.

very clear ❑ ❑ ❑ ❑ ❑ very turbid
5 4 3 2 1

3.1.6 The bottles are in the risk of being in the shadow (during some part of the day)

always ❑ ❑ ❑ ❑ ❑ never
1 2 3 4 5

3.1.7 Host is able to offer a glass of SODIS water. (Do you have a glass of SODIS water?)

❑ Yes (1) ❑ No (0)

3.1.8 Glasses are clean

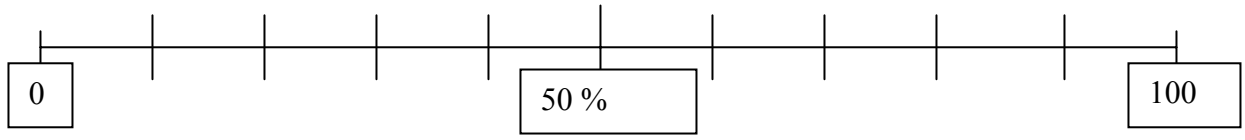
very clean ❑ ❑ ❑ ❑ ❑ very dirty
5 4 3 2 1

3.2 SODIS USE

3.2.1 With what did you treat your water before you heard about SODIS?

6 ❑ boiled the water
5 ❑ with chlorine
4 ❑ with filter
3 ❑ bought water
2 ❑ did not treat the water
1 ❑ other: .....

3.2.3 How big is the share of SODIS water in your overall drinking water (including tea, beer, juices etc.)?
Please indicate as part of the line:



3.2.4 How many plastic bottles (usable to do SODIS) does your family own?
.....

3.2.5 Do you think you need more bottles to have safe drinking water for the whole family?

5 ❑ Very much more.
4 ❑ Much more.
3 ❑ Quite more.
2 ❑ A little bit more.
1 ❑ No, does not need more.

3.2.6 Where did you get or what did you do with your plastic bottles since you heard about SODIS)? (more than one answer possible!)

9 ❑ got new bottles from the bottle center
8 ❑ got new bottles from neighbours, and/or: .....
7 ❑ gave bottles back to bottle center
6 ❑ gave bottles away to someone
5 ❑ threw bottles away
4 ❑ sold bottles
3 ❑ exchanged bottles for something else
2 ❑ owns still the same bottles as when started to do SODIS
1 ❑ others: .....

3.2.7 For how many people do you treat the water with SODIS?
.....

3.2.8 How many bottles of SODIS did you do the last three days?
.....

3.2.9 How many bottles of SODIS did you drink the last three days?
.....

3.2.10 How big are these bottles (on average)? Please indicate in liters:
.....

3.2.11 How many liters of SODIS does your family drink per day?
.....

3.2.12 How many days in the last week did you drink SODIS? (0-7)
.....

3.2.13 When do (did) you do SODIS (at which time of the day)?
.....

3.2.14 How much time of the day does it take to do SODIS? ***(not exposure of bottles to the sun!)***

..... ☐ don't know Minutes

3.2.15 How time-consuming do you find that?

1 ❑ Very time-consuming
2 ❑ Time-consuming.
3 ❑ Quite time-consuming.
4 ❑ A little bit time-consuming.
5 ❑ Not time-consuming.

3.2.16 Would it change a lot for you if it were more time-consuming?

5 ❑ Very much.
4 ❑ Much.
3 ❑ Quite much.
2 ❑ A little.
1 ❑ Nothing would change.

3.2.17 Do you do SODIS at the same time every day?

5 ❑ (Almost) always.
4 ❑ Often.
3 ❑ Sometimes
2 ❑ Rarely.
1 ❑ Never.

3.2.18 How much effort is it to prepare SODIS water?

1 ❑ Very much.
2 ❑ Much.
3 ❑ Quite much.
4 ❑ A little.
5 ❑ It is no effort.

3.2.19 Would it change a lot for you if it were more effortful to do SODIS?

1 ❑ Very much.
2 ❑ Much.
3 ❑ Quite much.
4 ❑ A little.
5 ❑ Nothing would change.

3.2.20 Do you enjoy preparing SODIS?

5 ❑ Very much.
4 ❑ Much.
3 ❑ Quite
2 ❑ A little bit.
1 ❑ Not at all.

3.2.21 How does SODIS water taste?

9 ❑ Very good.
8 ❑ Good.
7 ❑ Quite good.
6 ❑ A little bit good.
5 ❑ Neither good nor bad.
4 ❑ A little bit bad.
3 ❑ Quite bad.
2 ❑ Bad.
1 ❑ Very bad.

3.2.22 Is doing SODIS a habit for you?

5 ❑ A very strong habit.
4 ❑ A habit.
3 ❑ Quite a habit.
2 ❑ A little bit a habit.
1 ❑ No habit.

3.2.23 How easy is it for you to remember to do SODIS?

5 ❑ Very easy.
4 ❑ Easy.
3 ❑ Quite easy.
2 ❑ Not so easy.
1 ❑ Not easy at all.

3.2.24 Do other habits hinder you in doing SODIS?

1 ❑ Mostly.
2 ❑ Often.
3 ❑ Sometimes.
4 ❑ Rarely.
5 ❑ Never.

3.2.25 How often does it happen that you intend to do SODIS and then forget to do so?

1 ❑ Mostly.
2 ❑ Often.
3 ❑ Sometimes.
4 ❑ Rarely.
5 ❑ Never.

3.2.26 How much does it bother you if you forget to do SODIS?

5 ❑ Very much.
4 ❑ Much.
3 ❑ Quite much.
2 ❑ A little.
1 ❑ It does not bother me.

3.2.27 Are there any things that help you to remember to do SODIS and how much does each one help you to remember doing it?

Helps to remember to do SODIS	**How much does it help to remember?**
It is a routine, I just do it.	5 ❑ Nearly perfectly. 4 ❑ Helps a lot. 3 ❑ It helps. 2 ❑ Helps a little. 1 ❑ Does not help.
When I see the empty containers.	5 ❑ Nearly perfectly. 4 ❑ Helps a lot. 3 ❑ It helps. 2 ❑ Helps a little. 1 ❑ Does not help.

If I want to prevent diseases and/or want to remove bacteria.	5 ❑ Nearly perfectly. 4 ❑ Helps a lot. 3 ❑ It helps. 2 ❑ Helps a little. 1 ❑ Does not help.
If applicable (if not leave it out): When I see the SODIS sticker.	5 ❑ Nearly perfectly. 4 ❑ Helps a lot. 3 ❑ It helps. 2 ❑ Helps a little. 1 ❑ Does not help.
If applicable (if not leave it out): When I see the SODIS-contract about when and where I do SODIS.	5 ❑ Nearly perfectly. 4 ❑ Helps a lot. 3 ❑ It helps. 2 ❑ Helps a little. 1 ❑ Does not help.
other:	5 ❑ Nearly perfectly. 4 ❑ Helps a lot. 3 ❑ It helps. 2 ❑ Helps a little. 1 ❑ Does not help.

3.2.28 In which situations do you feel urged to do SODIS? Please state also, how much you feel urged.

Situations which create an urge to do SODIS	**How much do you feel urged?**
When you fear diseases and/or want to stay healthy and/or want to remove bacteria.	5 ❑ Very much. 4 ❑ Much. 3 ❑ Quite 2 ❑ A little bit. 1 ❑ Not at all.
If the raw water is unsafe.	5 ❑ Very much. 4 ❑ Much. 3 ❑ Quite 2 ❑ A little bit. 1 ❑ Not at all.
other:	5 ❑ Very much. 4 ❑ Much. 3 ❑ Quite 2 ❑ A little bit. 1 ❑ Not at all.

3.2.29 How important is SODIS for you?

5 ❑ Very important.
4 ❑ Important.
3 ❑ Quite important.
2 ❑ Not very important.
1 ❑ Not important.

3.2.30 Do you think it is worth it to do SODIS?

9 ❑ It is worth a lot more than it costs.
8 ❑ It is worth more than it costs.
7 ❑ It is worth quite more that it costs.
6 ❑ It is worth a little bit more than it costs.
5 ❑ It is worth the same as it costs.
4 ❑ It costs a little bit more than it is worth.
3 ❑ It costs more than it is worth.
2 ❑ It costs quite more than it is worth.
1 ❑ It costs a lot more than it is worth.

3.2.31 How difficult is it for you to do SODIS?

5 ❑ Very difficult.
4 ❑ Difficult.
3 ❑ Quite difficult.
2 ❑ Not very difficult.
1 ❑ Not difficult.

3.2.31b Why?

.....

3.2.32 How much do you want to do SODIS in the far future?

5 ❑ Very much.
4 ❑ Much.
3 ❑ Quite
2 ❑ A little bit.
1 ❑ Not at all.

3.2.33 Will you teach your children about SODIS?

5 ❑ Very probable.
4 ❑ Probably.
3 ❑ Quite probable.
2 ❑ A little bit probable.
1 ❑ Not probable.

PART 4: INFORMATION ABOUT SODIS

IF person has not heard about SODIS OR can NOT explain it OR does not know what SODIS is:

Give the information about SODIS of the separate "INFORMATION SHEET".

PART 5: GENERAL QUESTIONS

5.1 ABOUT SODIS

5.1.1 How available are bottles?

5 ❑ Very available.
4 ❑ Available.
3 ❑ Quite available.
2 ❑ A little available.
1 ❑ Not available.

5.1.2 If you could choose between the following drinking water, which one would you prefer?

4 ❑ boiled water
3 ❑ tap water
2 ❑ with SODIS treated water
1 ❑ with chlorine treated water

5.1.3 Do you think drinking SODIS water can make you healthier or less healthy?

9 ❑ Much healthier.
8 ❑ Healthier.
7 ❑ Quite healthier.
6 ❑ A little bit healthier.
5 ❑ No change.
4 ❑ A little bit unhealthier.
3 ❑ Quite unhealthier.
2 ❑ Unhealthier.
1 ❑ Much unhealthier.

5.1.4 How much money would it cost (does it cost) to treat your water with SODIS per week?

weekly..... ☐ don't know Z$

5.1.5 How expensive is that for you?

1 ❑ Very expensive.
2 ❑ Expensive.
3 ❑ Just all right.
4 ❑ Cheap.
5 ❑ (Almost) no costs.

5.1.6 Would it change a lot for you if SODIS costed more than that?

5 ❑ Very much.
4 ❑ Much.
3 ❑ Quite much.
2 ❑ A little.
1 ❑ Nothing would change.

5.1.7 How would (do) other people think about you when you do SODIS? (**Please answer, even if it is theoretical - just imagine.**)

9 ❑ Very positively.
8 ❑ Positively.
7 ❑ Quite positively.
6 ❑ A little bit positively.
5 ❑ Neither positive nor negative.
4 ❑ A little bit negatively.
3 ❑ Quite negatively.
2 ❑ Negatively.
1 ❑ Very negatively.

5.1.8 How do you think about others who do SODIS?

9 ❑ Very positively.
8 ❑ Positively.
7 ❑ Quite positively.
6 ❑ A little bit positively.
5 ❑ Neither positive nor negative.
4 ❑ A little bit negatively.
3 ❑ Quite negatively.
2 ❑ Negatively.
1 ❑ Very negatively.

5.1.9 How do you feel about SODIS?

9 ❑ Very positively.
8 ❑ Positively.
7 ❑ Quite positively.
6 ❑ A little bit positively.
5 ❑ Neither positive nor negative.
4 ❑ A little bit negatively.
3 ❑ Quite negatively.
2 ❑ Negatively.
1 ❑ Very negatively.

5.1.10 Do you think it is good or bad to do SODIS?

9 ❑ Very good.
8 ❑ Good.
7 ❑ Quite good.
6 ❑ A little bit good.
5 ❑ Neither good nor bad.
4 ❑ A little bit bad.
3 ❑ Quite bad.
2 ❑ Bad.
1 ❑ Very bad.

5.1.11 How much do you agree to these advantages and disadvantages?

	1 I agree very much	2 I agree	3 I quite agree	4 I agree a little	5 I neither agree nor disagree	6 I disagree a little	7 8 I quite disagree	9 I disagree	2 I do not agree at all
It is an easy way to treat water (not effortful, less laborious, no use of firewood, not time-consuming, understandable).	❑ 9	❑ 8	❑ 7	❑ 6	❑ 5	❑ 4 3	❑ 2	❑ 1	❑
It prevents diseases (diarrhea, cholera, kills germs and bacteria, effective, promotes good health, hygienic, treats water).	❑ 9	❑ 8	❑ 7	❑ 6	❑ 5	❑ 4 3	❑ 2	❑ 1	❑
The water tastes better than other treated water	❑ 9	❑ 8	❑ 7	❑ 6	❑ 5	❑ 4 3	❑ 2	❑ 1	❑
other:	❑	❑	❑	❑	❑	❑	❑	❑	❑
It is difficult to get bottles or bottles are unavailable	❑ 1	❑ 2	❑ 3	❑ 4	❑ 5	❑ 6 7	❑ 8	❑ 9	❑
It needs sunlight.	❑ 1	❑ 2	❑ 3	❑ 4	❑ 5	❑ 6 7	❑ 8	❑ 9	❑
It is only a small amount treatable.	❑	❑	❑	❑	❑	❑	❑	❑	❑
other:	1 ❑	2 ❑	3 ❑	4 ❑	5 ❑	6 7 ❑	8 ❑	9 ❑	❑

5.1.12 What do you think is the reason why others don`t use SODIS?

.....

5.2 HEALTH

5.2.1 When you drink water, how much do you think about its cleanness?

5 ❑ I think about it a lot.
4 ❑ I think about it.
3 ❑ I quite think about it.
2 ❑ I think about it a little bit.
1 ❑ I do not think about it.

5.2.2 How many members of your family have diarrhea or stomache problems (stomache pain or cramps, loose or bloody stool) at the moment?

.....

5.2.3 How often do you and they have diarrhea?

5 ❑ Almost always.
4 ❑ Often.
3 ❑ Sometimes
2 ❑ Rarely.
1 ❑ Never.

5.2.4 Where does diarrhea come from?

5 ❑ Knows about bacteria.
4 ❑ Knows that it is related with water, food and hygiene.
3 ❑ Mentions only food and/or hygiene (not water).
2 ❑ Has different theories than the above named. - Which?: .....
1 ❑ Does not know where it comes from.

5.2.5 Do you have more or less diarrhea when you treat your drinking water?

9 ❑ Much less diarrhoea
8 ❑ Less diarrhea.
7 ❑ Quite less diarrhea.
6 ❑ A little less diarrhea.
5 ❑ No difference.
4 ❑ A little more diarrhea.
3 ❑ Some more diarrhea.
2 ❑ More diarrhea.
1 ❑ Much more diarrhea.

5.2.6 How many members of your household had cholera in the last two months (strong, liquid diarrhea and /or vomiting)?

.....

5.2.7 If applicable: How many of these persons were under 5 years of age?

.....

Patient 1 (who?): ..... (e.g. child / aunt /...)	Patient 2 (who?): ..... (e.g. child / aunt /...)

5.2.8.1 How serious was this cases of cholera?	5.2.8.2 How serious were these cases of cholera?
5 ❑ Patient died. 4 ❑ Patient was in hospital / health clinic. 3 ❑ Patient was severely dehydrated. 2 ❑ Patient was lightly dehydrated. 1 ❑ Patient recovered fast.	5 ❑ Patient died. 4 ❑ Patient was in hospital / health clinic. 3 ❑ Patient was severely dehydrated. 2 ❑ Patient was lightly dehydrated. 1 ❑ Patient recovered fast.

Patient 3 (who?): ..... (e.g. child / aunt /...)	Patient 4 (who?): ..... (e.g. child / aunt /...)
5.2.8.3 How serious was this cases of cholera?	5.2.8.4 How serious were these cases of cholera?
5 ❑ Patient died. 4 ❑ Patient was in hospital / health clinic. 3 ❑ Patient was severely dehydrated. 2 ❑ Patient was lightly dehydrated. 1 ❑ Patient recovered fast.	5 ❑ Patient died. 4 ❑ Patient was in hospital / health clinic. 3 ❑ Patient was severely dehydrated. 2 ❑ Patient was lightly dehydrated. 1 ❑ Patient recovered fast.

5.3.9 Did the Cholera (outbreak) make you use more or less SODIS?

9 ❑ Very much more.
8 ❑ More.
7 ❑ Quite more.
6 ❑ A little bit more.
5 ❑ Neither more nor less.
4 ❑ A little bit less.
3 ❑ Quite less.
2 ❑ Less.
1 ❑ Very much less.

5.3 COMMUNICATION

5.3.1 How many people in your village do you know who do SODIS?

9 ❑ Everyone
8 ❑ Nearly all.
7 ❑ Most.
6 ❑ Some more than the half.
5 ❑ About half.
4 ❑ Some less than the half.
3 ❑ Few.
2 ❑ One or two.
1 ❑ Nobody.

5.3.2 How many times did you hear people talking about Sodis in the last week?

5 ❑ (Almost) always.
4 ❑ Often.
3 ❑ Sometimes.
2 ❑ Rarely.
1 ❑ Never.

5.3.3 How much do these conversations influence you?

5 ❑ Very much.
4 ❑ Much.
3 ❑ Quite much.
2 ❑ A little bit.
1 ❑ Not at all.

5.3.4 How many people initiated a talk with you about Sodis in the last two weeks?

5 ❑ Too many to count.
4 ❑ A lot of people.
3 ❑ Some people (3 or more).
2 ❑ Only a few (1 or 2).
1 ❑ No-one.

5.3.5 With whom did you talk about SODIS or water treatment lately?

.....

5.3.6 How much do you think about **talking about** Sodis?

5 ❑ Very often.
4 ❑ Often.
3 ❑ Sometimes
2 ❑ Rarely.
1 ❑ Never.

5.3.7 Do you talk more about Sodis than other people do?

9 ❑ Very much more than others.
8 ❑ More than others.
7 ❑ Quite more than others.
6 ❑ A little bit more than others.
5 ❑ Neither more nor less than others.
4 ❑ A little bit less than others.
3 ❑ Quite less than others.
2 ❑ Less than others.
1 ❑ Very much less than others.

5.3.8 How often do you talk about SODIS or water treatment?

5 ❑ (Almost) always.
4 ❑ Often.
3 ❑ Sometimes.
2 ❑ Rarely.
1 ❑ Never.

5.3.9 Why do you not talk more about SODIS?

.....

.....

5.3.10 When did you talk about water treatment the last time?

9 ❑ Today.
8 ❑ 1-3 days ago.
7 ❑ 4 days to 1 week ago.
6 ❑ 1 to 2 weeks ago.
5 ❑ 2 to 3 weeks ago.
4 ❑ 1 month ago.
3 ❑ 3 months ago.
2 ❑ Longer than 3 months ago.
1 ❑ Never.

5.3.11 How do other people think about SODIS or water treatment?

9 ❑ Very positively.
8 ❑ Positively.
7 ❑ Quite positively.
6 ❑ A little bit positively.
5 ❑ Neither positive nor negative.
4 ❑ A little bit negatively.
3 ❑ Quite negatively.
2 ❑ Negatively.
1 ❑ Very negatively.

5.3.12 If you talk about Sodis do people then upvalue or devalue you?

9 ❑ They upvalue me very much.
8 ❑ They upvalue me.
7 ❑ They quite upvalue me.
6 ❑ They upvalue me a little bit.
5 ❑ They neither upvalue nor devalue me.
4 ❑ They devalue me a little bit.
3 ❑ They quite devalue me.
2 ❑ They devalue me.
1 ❑ They upvalue me very much.

5.3.13 How important do you find it to talk about Sodis?

5 ❑ Very important.
4 ❑ Important.
3 ❑ Quite important.
2 ❑ Not very important.
1 ❑ Not important.

5.3.14 How keen are you to know more about Sodis?

5 ❑ Very keen.
4 ❑ Keen.
3 ❑ Quite keen.
2 ❑ Not very keen.
1 ❑ Not keen.

5.3.15 How competent do you feel when you talk about Sodis?

5 ❑ Very competent.
4 ❑ Competent.
3 ❑ Quite competent.
2 ❑ Not very competent.
1 ❑ Not competent.

5.3.16 How confident do you feel about your knowledge about Sodis?

5 ❑ Very confident.
4 ❑ Confident.
3 ❑ Quite confident.
2 ❑ Not very confident.
1 ❑ Not confident.

5.3.17 Do you think it is good or bad to talk about SODIS or water treatment?

9 ❑ Very good.
8 ❑ Good.
7 ❑ Quite good.
6 ❑ A little bit good.
5 ❑ Neither good nor bad.
4 ❑ A little bit bad.
3 ❑ Quite bad.
2 ❑ Bad.
1 ❑ Very bad.

5.3.18 Do you think you can help other people when you tell them about SODIS?

5 ❑ Very much.
4 ❑ Much.
3 ❑ Quite much.
2 ❑ A little bit.
1 ❑ Not at all.

5.3.19 How do (would) others think about you when you talk about water treatment? **(Please imagine, even if you do not talk about it)**

9 ❑ Very positively.
8 ❑ Positively.
7 ❑ Quite positively.
6 ❑ A little bit positively.
5 ❑ Neither positive nor negative.
4 ❑ A little bit negatively.
3 ❑ Quite negatively.
2 ❑ Negatively.
1 ❑ Very negatively.

5.3.20 How do you think about others when they talk about water treatment?

9 ❑ Very positively.
8 ❑ Positively.
7 ❑ Quite positively.
6 ❑ A little bit positively.
5 ❑ Neither positive nor negative.
4 ❑ A little bit negatively.
3 ❑ Quite negatively.
2 ❑ Negatively.
1 ❑ Very negatively.

5.3.21 How do you feel about talking about water treatment or SODIS?

9 ❑ Very positively.
8 ❑ Positively.
7 ❑ Quite positively.
6 ❑ A little bit positively.
5 ❑ Neither positive nor negative.
4 ❑ A little bit negatively.
3 ❑ Quite negatively.
2 ❑ Negatively.
1 ❑ Very negatively.

5.3.22 In which situations do you feel urged to talk about Sodis?

.....
.....

5.3.23 In which situations (or with which people) is it not advisable to talk about Sodis? Why?

.....
.....
.....

5.3.24 Were you ever visited by a promoter (**not an interviewer!**) who was talking about SODIS?

❑ Yes (1) ❑ No (0)

5.3.25 Did you get a token for SODIS bottles from someone in the last month? (If yes, from whom?)

❑ Yes (1) ❑ No (0) from whom:.....

5.3.26 Have you heard about a bottle center or a street seller of bottles (for SODIS)?

❑ Yes (1) ❑ No (0)

5.3.27 Have you heard about or seen a market-crier or announcer with a poster in the streets advertising SODIS?

❑ Yes (1) ❑ No (0)

IF YES: (IF NO PLEASE GO TO QUESTION 5.3.31 - last question of this part)

5.3.28 Did it convince you to start doing SODIS?

5 ❑ Very much.
4 ❑ Much.
3 ❑ Quite much.
2 ❑ A little bit.
1 ❑ Not at all.

5.3.29 Did it help you to remember to do SODIS?

5 ❑ Very much.
4 ❑ Much.
3 ❑ Quite much.
2 ❑ A little bit.
1 ❑ Not at all.

5.3.30 Did you prepare more SODIS water after hearing/seeing the market-crier?

5 ❑ Very much.
4 ❑ Much.
3 ❑ Quite much.
2 ❑ A little bit.
1 ❑ Not at all.

5.3.31 Will you talk about SODIS in the next two weeks?

5 ❑ Very probable.
4 ❑ Probably.
3 ❑ Quite probable.
2 ❑ A little bit probable.
1 ❑ Not probable.

5.4 ABOUT THE CAMPAIGN

5.4.1 How do you feel about the whole SODIS campaign?

9 ❑ Very good.
8 ❑ Good.
7 ❑ Quite good.
6 ❑ A little bit good.
5 ❑ Neither good nor bad.
4 ❑ A little bit bad.
3 ❑ Quite bad.
2 ❑ Bad.
1 ❑ Very bad.

5.4.1b Why?

.....

5.4.2 How trustworthy / reliable is the information that you are receiving about SODIS?

5 ❑ Very trustworthy
4 ❑ Trustworthy
3 ❑ Quite trustworthy
2 ❑ A little bit trustworthy
1 ❑ Not trustworthy

5.4.2b What makes it less trustworthy?

.....

5.4.3 Do you have a SODIS reminder in or on your home (stickers / posters / papers / implementation contract)? *[For the interviewers: please have a picture with an example for each of the kinds of reminders on it, so that people understand what you are asking for. Please have them identify or let them show you, which kind it is.]*

❑ Yes (1) ❑ No (0)

IF NO 5.4.4 Did you ever have a reminder ?

❑ Yes (1) ❑ No (0)

IF NO Please go to question 5.4.7.

5.4.5 Which kind of reminder is or was it?

5 ❑ Prompt (inside sticker).
4 ❑ Public commitment (outside sticker).
3 ❑ Implementation intention contract.
2 ❑ Poster.
1 ❑ Other: .....

5.4.6 When did you receive the reminder?

.....

5.4.7 Will you do SODIS regularly in the next two weeks?

5 ❑ Very probable.
4 ❑ Probably.
3 ❑ Quite probable.
2 ❑ A little bit probable.
1 ❑ Not probable.

5.4.8 What did SODIS change in your or your family's life?

.....

END

Remarks:

.....
.....
.....

CV of author:

Personal Details

Full name:	Silvie Kraemer
Date of birth:	22.06.1979
Place of birth:	Stuttgart, Germany
Nationality:	German
Contact:	(0041) 78 642 95 75, silvie-k@web.de

Education

09.2006 - 09.2009	PhD in psychology for sustainable development at the Eawag, the water research institute of the ETH in Zürich, Switzerland Graduation with „insigni cum laude“
04.2006 – 09.2006	Course „Environmental behaviour and risk perception“ at the distance University Hagen
06.2002 – 03.2003	Study abroud at the University of Queensland in Brisbane, Australia
06.2000 – 09.2006	Studies of Psychology at the Julius-Maximilians-University, Würzburg, graduation with Master, grade: A Major: Social psychology Minor: Philosophy
1994 – 1999	College Hohenschwangau in Füssen Graduation with A-levels („Abitur“), grade: 1,7 (from 1-6)
1990 – 1994	Ecumenical High-school (Gymnasium) in Bremen
1985 – 1990	Preschool and elementary school in Bremen

Employment history

09.2009 - today	80% employment at “Eawag: Aquatic science” Tasks: Project management and research about success factors for participatory processes
06.2009 - today	Freelance work for “Eartheffect: Implementing Environmental Solutions” Tasks: Consultant in environmental psychological questions, formulating project ideas, writing proposals, fundraising, implementing projects
09.2006 - 09.2009	Developmental and project work to disseminate solar water disinfection in high-density areas in Zimbabwe Focus: Environmental psychology in developing countries, campaign design and management, behaviour change Tasks: Preparation and implementation of campaign, building contact to collaborators, forming, training and leading the implementation team, financial management, reporting
11.2003 – 08.2004	Internship at Consultancy „Aperio“ in Würzburg
03.2004 – 04.2004	Internship at OroVerde – Foundation for Tropical forests in Frankfurt a.M.
07.2003 – 10.2003	Internship at the Federal Office for Conservation in Bonn

Skills

Languages	English (A-level Major, several years of staying abroad, constant use at work and in private life), French (5 years at school), Spanish (beginner)
IT	Microsoft Windows, Microsoft Office, SPSS, Lisrel, Medialab, Modeling for agent-based simulation

Scientific work

Dissertation	The Behaviour Change Process of Solar Water Disinfection
Main publications	Kraemer, S. M., & Mosler, H.-J. (2010). Persuasion Factors Influencing the Decision to Use Sustainable Household Water Treatment. International Journal of Environmental Health Research, *20*(1), 61-79
	Kraemer, S. M., & Mosler, H.-J. (accepted). Differentiating between User Types and Relapsers of Solar Water Disinfection in a Long-Term Study in Zimbabwe. Journal of Health Psychology.
	Kraemer, S. M., & Mosler, H.-J. (resubmitted). Effectiveness and effects of promotion strategies for behaviour change. Applied Psychology: An international review.
	3 more publications currently in preparation
Presentations	7 presentations and 4 posters at major conferences (e.g. Conference of International Applied Psychology (IAPS) 2008 in Rome, Italy or Household Water Treatment Systems conference in Dublin, Ireland.
	4 presentations for university students (e.g. at TU Dresden, the ETH or at a WSC-SD conference)
	Several workshops and presentations for other organizations or networks (e.g. WASH cluster in Harare)
Master thesis	The Explanation of Sustainable Consumption with Implicit Attitude, Explicit Attitude and Priming

Interests

Volunteer work	Active member of a german and swiss club for environmental psychology ("Initiative Psychologie im Umweltschutz"): Attendance of conferences, commitment to social marketing, strategy and networking; co-organizing two conferences and organizing one series of professional training
Recreational	Rock-climbing, improv and classic theatre, scuba diving, literature, traveling

References

Prof. Hans-Joachim Mosler, Eawag
Ueberlandstrasse 133, 8600 Zurich, Schwitzerland
mosler@eawag.ch; 0041 44 823 55 42

Dr. Kevin McGuigan, RCSI (Royal College of Surgeons in Ireland)
123 St. Stephen's Green, Dublin 2, Ireland
kmcguigan@rcsi.ie; 00353 1 40 22 207

Sharon Murinda, IWSD (Institute for Water and Sanitation Development)
7 Maasdorp Avenue, Alexandra Park, Harare, Zimbabwe
sharonmurinda@gmail.com; 00263 91 277 39 90